Estimated State Planning & Research Program
Part II – Research

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U.S. Department of Transportation
Federal Highway Administration

SPR-PL-1(179)
Fiscal Year 2011
(July 1, 2010 – June 30, 2011)

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Glossary of Acronyms and Abbreviations

Most of the acronyms and abbreviations shown in the following table are not defined in the main text of this publication. Please use this table as a reference for defining these terms.

AASHTO	American Association of State Highway & Transportation Officials
AC	Asphaltic Concrete
ACFC	Asphalt Concrete Friction Course
ACMS	Advanced Construction and Maintenance Systems
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
AHRRC	Arizona Hospitality Research and Resource Center
AHS	Automated Highway Systems
ALISS	Accident Location Identification Surveillance System
APL	Approved Products List
AR-AC	Asphalt-Rubber Asphalt Concrete
AR-ACFC	Asphalt-Rubber/Asphalt-Concrete Friction Course
ARS	Arizona Revised Statutes
ASU	Arizona State University
ATC	Automatic Traffic Counter
ATIS	Advanced Traveler Information System
ATRC	Arizona Transportation Research Center
AVL	Automatic Vehicle Location: GPS-enabled technologies
BYU	Brigham Young University
Caltrans	California Department of Transportation
CCTV	Closed-Circuit TV
CIE	*Commission Internationale de L'Eclairage*
CRM	Crumb Rubber Modifier
CVISN	Commercial Vehicle Information Systems Network
DOT	Department of Transportation
DPS	Department of Public Safety
ENTERPRISE	Evaluation of New Technologies for Roads Program Initiatives in Safety and Efficiency
FHWA	Federal Highway Administration
FM	Frequency modulation
FWD	Falling Weight Deflectometer
FY	Fiscal Year
G4	A type of guard rail
GCNP	Grand Canyon National Park
GIS	Geographic Information System
GOHS	Governor’s Office of Highway Safety
GPS	General Pavement Studies
GPS	Global Positioning Satellite
GTSAC	Governor’s Traffic Safety Advisory Council
HAR	Highway Advisory Radio

HCRS	Highway Condition Reporting System
HMA	Hot Mix Asphalt
HMAC	Hot Mix Asphaltic Concrete
HOV	High Occupancy Vehicle
HPC	High Performance Concrete
HPS	High-Pressure Sodium
IDMS	Integrated Document Management System
IES	Illuminating Engineering Society
ISPMMS	Integrated Sign and Pavement Marking Management System
ITD	Intermodal Transportation Division
ITG	Information Technology Group
ITS	Intelligent Transportation System
IV	Intelligent Vehicle
JLBC	Joint Legislative Budget Committee
JPA	Joint Project Agreement
LOS	Level of Service
LPS	Low-Pressure Sodium
LTAP	Local Technical Assistance Program
LTPP	Long Term Pavement Performance
MAG	Maricopa Association of Governments
MH	Metal Halide
MOE	Measures of Effectiveness
MP	Milepost
MSE	Mechanically-Stabilized Earth
MPD	Multimodal Planning Division
MUTCD	Manual on Uniform Traffic Control Devices
MVD	Motor Vehicle Division
N/A	Not Applicable
NAU	Northern Arizona University
NCAT	National Center for Asphalt Technology
NCHRP	National Cooperative Highway Research Program
NOAA	National Oceanographic and Atmospheric Administration
NTCIP	National Transportation Communications for Intelligent Transportation Systems Protocol
NTPEP	National Transportation Product Evaluation Program
OGFC	Open-Graded Friction Courses
P3	Pollution Prevention Plan
PC	Personal Computer
PIJ	Project Investment Justification
PM10	Particulate Matter less than 10 microns in diameter
PM2.5	Particulate Matter less than 2.5 microns in diameter
PMS	Pavement Management System
PRIDE	Product Resource Investment Deployment and Evaluation
R&D	Research & Development
R/W	Right-of-Way
RFP	Request for Proposal

RV	Recreational Vehicle
RWIS	Roadway Weather Information System
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SGC	Sand-Gravel-Cobbles
SHRP	Strategic Highway Research Program
SHSP	Strategic Highway Safety Plan
SPR	State Planning & Research
SPS	Specific Pavement Studies
SPUI	Single-Point Urban Interchange
SR	State Route
TAC	Technical Advisory Committee
TBD	To Be Determined
TEA-21	Transportation Equity Act for the 21st Century
TI	Traffic Interchange
TNM	Traffic Noise Model
TRB	Transportation Research Board
TTI	Texas Transportation Institute
UDOT	Utah Department of Transportation
U of A	University of Arizona
VMS	Variable Message Sign
VOC	Volatile Organic Compound
VSL	Variable Speed Limit
WASHTO	Western Association of State Highway & Transportation Officials
WIM	Weigh-in-Motion
WSDOT	Washington State Department of Transportation

Overview

The Arizona Transportation Research Center (ATRC) directs the Arizona Department of Transportation (ADOT) research program.

ATRC MISSION — The ATRC mission is to pursue, create and share knowledge in transportation systems and programs.

ATRC VISION — ATRC sets the standard of excellence for transportation research, product evaluation and library services.

The research program encompasses seven research emphasis areas:

- Environment
- Intelligent Transportation Systems
- Maintenance
- Materials & Construction
- Planning & Administration
- Structures
- Traffic & Safety

The research program also includes the ADOT Product Resource Investment Deployment and Evaluation (PRIDE) program. The review and acceptance of new products for possible use by ADOT is coordinated through the PRIDE program. The Approved Products List (APL) is also maintained under the PRIDE program.

ATRC houses and operates the main ADOT library. The library is maintained by a full time librarian. The ATRC Library is open to ADOT employees, transportation faculty in Arizona universities, Arizona local and county transportation staff, and the public.

The library catalog is available on the Internet. The library collection currently includes over 30,000 entries, including over 60 journal and magazine subscriptions.

This ATRC annual report provides descriptions and progress updates for new and ongoing projects in the Fiscal Year (FY) 2011 *Estimated State Planning & Research (SPR) Program, Part II*. There are 62 research projects and 16 research support programs included in this year's program.

The Research Support section of this document provides a brief overview of budgets outside the direct research studies encompassed by the seven research emphasis areas.

Four (4) project reports were published during FY 2010. In addition, seven (7) projects were completed and are awaiting publication as this report is being prepared. These projects are listed in Tables 1A and 1B.

TABLE 1A
Fiscal Year 2010 Published Research Projects

ID #	Title	Project Manager
SPR-583	Open Source Software Study	Rost
SPR-630	Critical Review of ADOT's Hot Mix Asphalt Specifications	Dimitroplos
SPR-657	Options for Reducing Copper Theft	DiBugnara
SPR-658	Performance Testing of HPC on the Sunshine Bridge Project	Dimitroplos

TABLE 1B
Fiscal Year 2010 Completed Research Projects Awaiting Publication

ID #	Title	Project Manager
SPR-602	Sampling and Analyses of Storm Water Runoff	Kombe
SPR-605-1	Investigations of Environmental Effects on Freeway Acoustics	Dimitroplos
SPR-619	Antelope Movements North of Interstate 40 in Arizona	Kombe
SPR-624	Hazardous Materials Transportation in Arizona	Kombe
SPR-655	Identifying Customer-Focused Performance Measures	Stewart
SPR-660	Arizona Transportation History	Rost
SPR-663	SB2008-29: Development of Intersection Performance Measures for Timing Plan Maintenance Using an Actuated Controller – Phase I	DiBugnara

In addition, six (6) projects were cancelled during fiscal year 2010. These projects are listed below:

SPR-547 *Arizona Statewide Safety Project Analysis Model* was cancelled at the request of the Technical Advisory Committee.

SPR-586 *Investigation of Earth Pressure on Concrete Cantilever Retaining Wall for Variable Quality Backfill* was cancelled at the request of the Technical Advisory Committee.

SPR-625 *Safety Enhancements for Median Crossovers* was cancelled at the request of the Technical Advisory Committee.

SPR-632, *Development of Materials for Repairing AR-ACFC Surfaces* was cancelled at the request of the Technical Advisory Committee.

SPR-641 *Oversized Vehicle Study* was cancelled at the request of the Technical Advisory Committee.

SPR-661 *Engineering Design Methods to Mitigate Damages from Earth Fissures* was cancelled at the request of the Technical Advisory Committee.

Publications

In addition to final research reports, ATRC publishes the following items:

- Research Notes—Four page summaries of individual research reports
- Research Center newsletter
- Quick Studies—Results of fast, low cost research on issues ADOT faces
- Annual Implementation Report—presentation of application of research
- Research Program Manual—Policies and procedures governing State Planning and Research projects at the Arizona Transportation Research Center
- Annual SPR Book—Annual report on research projects underway at the Arizona Transportation Research Center.
- PRIDE Program Annual Report—Annual report of ADOT's Product Resource Investment Deployment and Evaluation (PRIDE) Program.
- Peer Exchange Reports—Reports produced as a result of FHWA's peer exchange program.

Further information on completed projects may be obtained from the project managers. Copies of the published reports and other materials may be obtained from the ATRC Librarian. Telephone numbers and e-mail addresses for ATRC staff are shown in Table 2. Reports are also available on the Internet at: http://www.azdot.gov/TPD/ATRC/publications/index.asp.

TABLE 2
ATRC CONTACT INFORMATION

ATRC STAFF	PHONE NUMBERS	E-MAIL ADDRESSES
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Research Project Managers		
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Dianne Kresich	(602) 712-3134	dkresich@azdot.gov
Steve Rost, Ph.D.	(602) 712-6348	srost@azdot.gov
Vacant – 1 position	(602) 712-3137	
Librarian		
Dale Steele	(602) 712-3138	dsteele@azdot.gov
Technical & Administrative Support		
Evelyn Howell – Technical Editor	(602) 712-6346	ehowell@azdot.gov
Sandra Quijada – Administrative Assistant	(602) 712-4052	squijada@azdot.gov
Vacant – PRIDE Program Manager		
Anthony “AJ” Kerin – PRIDE Program Engineering Assistant	(602) 712-6430	akerin@azdot.gov
ATRC FAX	(602) 712-3400	

Departmental Oversight of ATRC

The ADOT Research Council oversees the research effort. The Research Council evaluates and rates proposals for new research, including pooled fund projects, thereby selecting new research projects. The Council monitors project activity and implementation and provides guidance to ATRC on the research program. The Council reviews technical advisory committee membership for research projects. The Council typically meets once per year to evaluate the major project proposals (budgets greater than $25,000) and holds two other business meetings during the year.

Membership in the Research Council is voluntary. With the exception of the FHWA Arizona Division, there are no automatic or organizational positions on the Council. Members are appointed by the ATRC director.

Research Council members are shown in Table 3.

TABLE 3
Research Council

Name	Group
Julio Alvarado	Assistant State Engineer, Construction Group
Matthew Burdick	Director, Communication & Community Partnerships (CCP)
John Carlson	Assistant Director, Government Relations
Jim Delton	State Materials Engineer, Materials Group
Anne Elllis - Chair	Director, Transportation Research Center
Dallas Hammit	Deputy State Engineer, Operations
Lonnie Hendrix	State Maintenance Engineer, Maintenance Group
Mark Hodges	Director, Data Management and Analysis
Kelly LaRosa	Transportation Specialist, Federal Highway Administration (FHWA)
Mike Manthey	State Traffic Engineer, Traffic Group
Sam Maroufkhani	Deputy State Engineer, Development
Jean Nehme	State Bridge Engineer, Bridge Group
Scott Nodes	Assistant State Engineer, Transportation Technology Group
Mike Normand	Director, Community Grant Services
Floyd Roehrich, Jr.	State Engineer, Intermodal Transportation Division
Suzan Tasvibi-Tanha	Information Technology Group
Tim Tait	Director, Community Relations (CCP)
Wendy Terlizzi	Statewide Program Manager, Water Quality Group
Mary Viparina	Assistant State Engineer, Roadway Group
Todd Williams	Director, Office of Environmental Services

Financial and statistical data are presented in the *SPR Program Budgets* and *Program Statistics* sections. The amount of new funding for FY 2011 is estimated at approximately $3.6 million. As of March 31, 2010, a total of $3,731,491 is available in funds carried forward from prior programs from 2006 through 2009. Fiscal year 2010 funds total $3,448,000 and have been carried forward separately.

Summaries of current SPR projects are presented for each of the seven research emphasis areas, grouped by emphasis area. The FY 2011 budget is presented as three basic programs: Administration of Research (SPR-100), Research Projects (to be selected, SPR-XXX), and Portfolio Balance and Adjustment Projects (SPR-900), totaling $3,640,000. Information regarding other types of projects may be found in the *Research Support Programs* and *Pooled Fund Program* sections, respectively.

Also included in this Report is the *Publications Catalog for the Arizona Transportation Research Center,* which lists all of the currently available research reports published by ATRC.

List of Projects

The following tables list each of the ongoing ATRC projects. Each project is classified in one of the following categories: E: Environment, I: Intelligent Transportation Systems (ITS), M: Maintenance, MC: Materials and Construction, PA: Planning and Administration, R: Research Support, S: Structures, and T: Traffic and Safety.

State Planning & Research Funded Program

ID No.	Project Name	Area
SPR-100	*Administration of Research*	R
SPR-110	*ATRC Library Resources*	R
SPR-111	*Transportation Research Board Correlation/AASHTO*	R
SPR-112	*Administration of Research*	R
SPR-113	*Support Staff Salaries*	R
SPR-114	*Research Reports – Technical Editing and Printing*	R
SPR-116	*PRIDE Program*	R
SPR-117	*Local Technical Assistance Program*	R
SPR-118	*Transportation Research Quick Study Program*	R
SPR-125	*NCHRP*	R
SPR-127	*Small Budget Studies*	R
SPR-396	*LTTP and Other Test Section Management and Evaluation*	MC
SPR-493	*Bridge Foundation Design Parameters and Procedures for Bearing in SGC Soil*	S
SPR-500	*Aggregate Sources for Construction and Maintenance in Northern Arizona*	M
SPR-577	*Pavement Noise Study*	MC
SPR-587	*Evaluation of Salvage and Replanted Native Plants on ADOT Projects*	E
SPR-589	*Determination of 404 Permit and Habitat Restoration Requirements*	E

ID No.	Project Name	Area
SPR-600	*Effectiveness of Microbe Application to Petroleum Spills at Crash Sites*	E
SPR-603	*Evaluation of Measures to Minimize Wildlife-Vehicle Collisions & Maintain Wildlife Permeability – Kohls Ranch Section, State Route 260*	E
SPR-604	*Real-Time Adaptive Ramp Metering: Phase 2– Implementation and Enhancement*	I
SPR-605	*Investigations of Environmental Effects on Freeway Acoustics*	MC
SPR-606	*Implementation of the Mechanistic-Empirical (M-E) Design Guide for Arizona*	MC
SPR-613	*Quantifying the Impact of Opening a New Segment of Freeway*	PA
SPR-617	*Evaluate Effects of Snowplow and De-icing Chemicals on Rubberized Pavements*	M
SPR-618	*Land Use and Traffic Congestion*	PA
SPR-626	*State Route 64 Wildlife Accident Reduction Study Monitoring*	E
SPR-627	*State-of-the-Art Evaluation of Traffic Detection and Monitoring Systems*	I
SPR-628	*Evaluation of Maintenance Strategies for ADOT*	M
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SPR-633	*Economical Concrete Mix Designs Utilizing Blended Cements, Performance Based Specifications, and Rational Pay Factors*	MC
SPR-634	*A Platform for Evaluating Emergency Evacuation Strategies*	I
SPR-640	*Cost-Effectiveness of Mobile Enforcement*	PA
SPR-642	*Delivery of a Technical Curriculum Using Learner-Based Instruction and Communication Modalities in a Distributed Environment*	PA
SPR-644	*Continuum Damage Theory Applied for Asphalt Rubber Mixtures*	MC

ID No.	Project Name	Area
SPR-645	*Automatic Vehicle Location (AVL) and Maintenance Work Effort Tracking*	I
SPR-646	*AASHTOWare Turborelocation Software Development*	PA
SPR-647	*Elk Movements Associated with a High-Traffic Highway: Interstate-17*	E
SPR-648	*Crash Related Education, Enforcement, and Engineering Factors*	T
SPR-649	*Safety Issues Due to Unforeseen Stoppage of High Speed Mainline Traffic*	M
SPR-650	*Predicting Desert Tortoise (Gopherus agassizzii) Habitat and Identifying Movement Patterns within the Proposed Highway 95 Realignment*	E
SPR-651	*Incorporating Safety Performance into Project Design Decision-Making for Cost Effective Safety Enhancements*	T
SPR-652	*Countermeasures to Reduce Large Truck Crashes*	T
SPR-653	*Arizona VII Initiative: Proof of Concept/Operational Testing*	I
SPR-654	*Options & Impacts of Measures to Reduce Single-Occupant Vehicle (SOV) Traffic*	PA
SPR-656	*Asphalt Rubber Mixtures Susceptibility to Moisture Damage*	MC
SPR-659	*Genetic Variation of Pronghorn across US Highway 89 and State Route 64*	E
SPR-662	*Cost Effectiveness of MVD Fee Collections*	PA
SPR-671	*Data Analysis Methodology to Identify Effective Countermeasures for Reducing Fatalities and Injuries on Arizona Roadways*	T
SPR-672	*Development of a Traffic Data Input System in Arizona for the Mechanistic Empirical Pavement Design Guide*	MC
SPR-673	*Performing Lifecycle Cost Analysis of HPC and Developing HPC Specifications for ADOT Bridge Projects*	MC
SPR-674	*Engineering Properties of Recycled ARFC Overlays*	MC

ID No.	Project Name	Area
SPR-675	*Effectiveness of Young Driver Training and Graduated Licensing Laws*	T
SPR-676	*Assessing How "New Media" Can Bolster ADOT's Outreach and Communication Effectiveness*	PA
SPR-677	*Evaluation of Measures to Promote Desert Bighorn Sheep Permeability: US Highway 93*	E
SPR-678	*Dynamic Routing for Incident Management*	I
SPR-679	*Platform for Evaluating Emergency Evacuation Strategies – Phase II*	I
SPR-680	*Development of Intersection Performance Measures for Timing Plan Maintenance Using an Actuated Controller – Phase II: Data Collection*	T
SPR-681	*Work Zone Instant Driver Warnings: Speed or Penalty Messages*	I
SPR-682	*Analysis of Freeway Bottlenecks: Capacity Reduction and Temporal Variations*	I
SPR-683	*Feasibility of CAD Web Menus*	PA
SPR-686	*Arizona Highways Magazine's Impact on Tourism*	PA
SPR-687	*Analysis of the State of the Art of Precast Concrete Bridge Substructure Systems*	S
SPR-688	*Effectiveness of Photo Enforcement in Phoenix Metro Area*	T
SPR-689	*Performance Evaluation of a Highway Retrofit for Wildlife: I-17 Munds Park to Woods Canyon*	E
SPR-690	*Automatic Vehicle Location (AVL) for Maintenance Work Effort Tracking: Phase 2 Integration*	M
SPR-691	*Development of Application Rate Guidelines for Winter Storm Management Chemical Additives in Use by ADOT through an Ambient Monitoring System*	M
SPR-692	*Development of a Comprehensive Plan to Enhance ADOT's Pavement Management Forecasting and Decision Making Capability*	MC

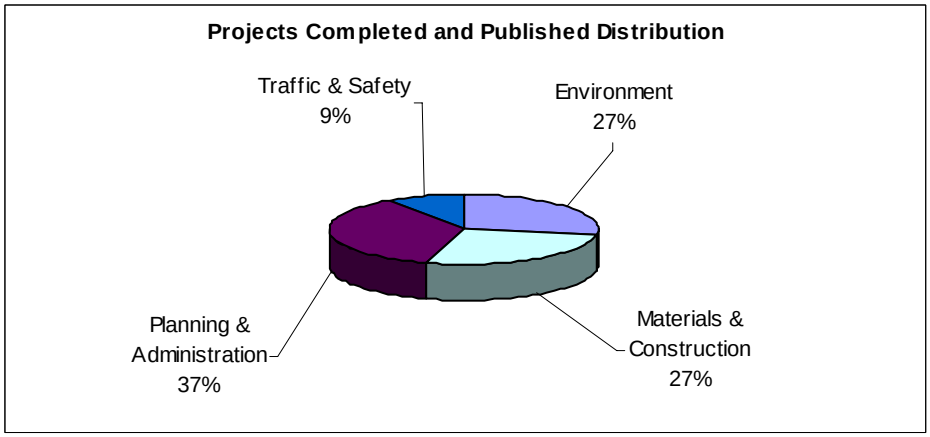
ID No.	Project Name	Area
SPR-693	*Development of an Enterprise Data Management System for Deployment of a Comprehensive Safety Assessment*	T
SPR-694	*Evaluation of Rural Traffic Operations Center Capabilities and Needs*	M
SPR-695	*SB2010-33: National Household Travel Survey Supplement for Arizona*	PA
SPR-696	*SB2010-34: A Preliminary Study of Climate Adaptation Issues for the Statewide Transportation System in Arizona*	E
SPR-697	*SB2010-35: Wrong Way Freeway Ramp Vehicle Detection*	T
SPR-XXX	*Projects for Fiscal Year 2011 (to be selected)*	R
SPR-900	*Portfolio Balancing and Adjustment Projects*	R
SPR-995	*Director's Special Projects*	R
SPR-996	*Project Additions*	R
SPR-997	*Participation Projects*	R
SPR-998	*Budget Closeout Funds*	R
SPR-999	*Special Projects/Contingency*	R
	TOTALS	

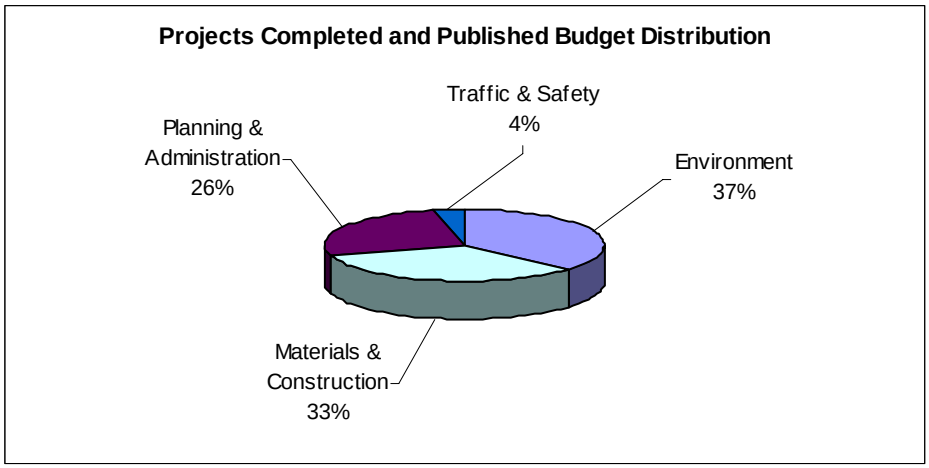
Statistics

Eleven (11) projects were completed, accounting for a budget of $672,772, in FY 2010 (July 1, 2008 through March 31, 2010). Not all of the completed projects have been published as of the publication of this work plan. The distribution of these projects by emphasis area is shown below.

FY 2010 Project Completion Summary

Category	No. of Projects	Funds Spent
Environment	3	$246,083
ITS		
Maintenance		
Materials & Construction	3	$224,890
Planning & Administration	4	$176,799
Structures		
Traffic & Safety	1	$25,000
Totals	**11**	**$672,772**

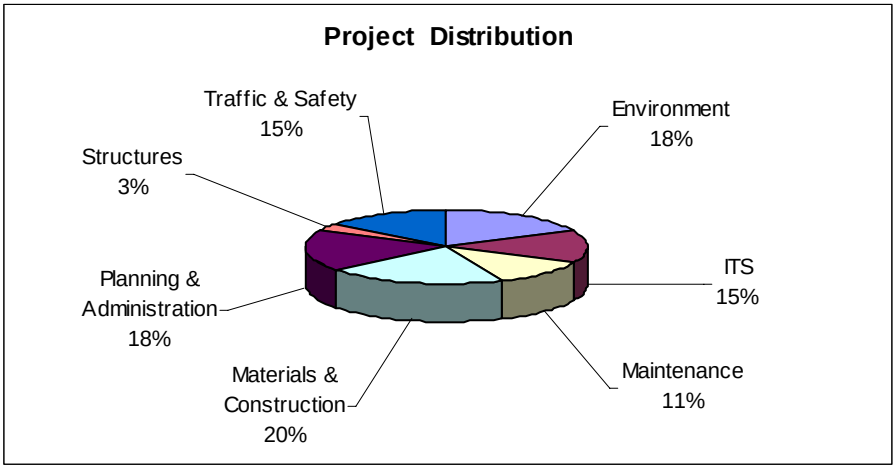


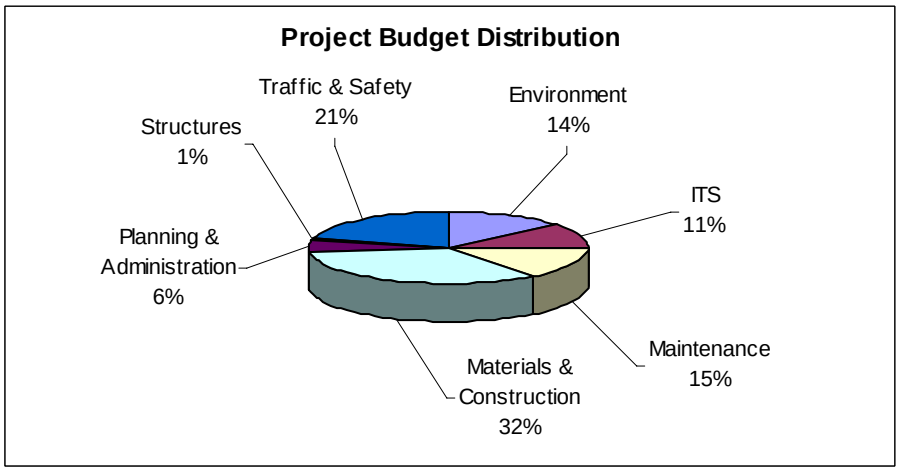


There are 62 ADOT research studies in the current program.

Current Research Projects

Category	Number of Projects	Budget ($)
Environment	11	647,532
ITS	9	507,623
Maintenance	7	670,223
Materials & Construction	13	1,507,018
Planning & Administration	11	258,098
Structures	2	39,000
Traffic & Safety	9	957,109
Totals	**62**	**$4,586,603**





Environment – PROJECTS

SPR-587, *Evaluation of Salvage and Replanted Native Plants on ADOT Projects*

Research Agency:	Logan Simpson Design, Inc.	FY Authorization:	2005
Principal Investigator(s):	Judy Melke, RLA	Contract Date:	06/05/2007
Contract Amount:	$74,973	Original Completion Date:	03/31/2009
Program Budget:	$75,000	Estimated Completion Date:	10/31/2010
Expenditures to date:	$61,141	Is project on schedule?	No
Available Amount:	$13,833	ADVANTAGE No.	R058717P
Percent complete	90%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

ADOT in the construction of highway projects over the last 10 years has transplanted substantial quantities of plant species that provide a major contribution to the area ecosystem and visual quality of highway projects. The cost of this planting on many projects can run $200,000 to $300,000 per mile. On SR 87 and US 93 heavy emphasis was placed on salvaging and transplanting of Saguaros, Ocotillo, Barrel and Yucca and some native trees. The plants salvaged and replanted on projects are watered one or two years after replanting as plant establishment. Because of the nature of the plants they may not show survival or mortality until they have been in the ground for 3 to 8 years. Since a number of plantings have been in the ground 5 to 10 years an inventory based on the projects' plantings with an evaluation of survival and mortality would benefit the planning, design and construction of projects.

The salvage and replanting of plant materials can have a major visual and ecosystem effect on projects. At the present time no evaluations have been made that can contribute to our knowledge basis and towards improvement of project design. The Department annually spends several hundred thousand dollars per mile on salvaging and replanting on projects throughout the state. This would be a valuable expenditure when considering the cost for success and failure related to planting and re-establishment of these unique plants on highway projects

The resulting benefits would include the following:

- Since many of the species planted are in a time period when their survival or mortality can be determined, assessing the survival and mortality rate would provide information on species that salvage well and have a high level of survival.
- Research the contributing factors for survival and mortality.
- Develop additional criteria selection for salvage for replanting.

Environment

RESEARCH OBJECTIVES

1. Quantify survivability rates of transplanted saguaros, ocotillos, barrels, and trees on selected ADOT projects.
2. Quantify and compare survival rate of move-once saguaros to move-twice saguaros.
3. Determine the cost effectiveness of salvaging move-once and move-twice saguaros.
4. Quantify and compare the survival rates of small cacti and large cacti.
5. Determine cost-effectiveness of salvaging small and large cacti

EXPECTED IMPLEMENTATION

ADOT has a number of projects now reaching an age where salvage and replanting materials could be evaluated to provide effective determinations. An evaluation of salvage techniques and establishment techniques would enable the Department monies to be spent more effectively.

STATUS OF THE RESEARCH

This project is nearing completion with a draft report already reviewed by the TAC. The project should be completed by October 31, 2010.

TECHNICAL ADVISORY COMMITTEE

LeRoy Brady	ADOT Roadside Development (Champion)
Vicki Bever	ADOT Natural Resources
Michael Daehler	ADOT Environmental Planning Group
Steve Thomas	FHWA Arizona Office
Mathew Moul	ADOT Globe District
Ted Littlefield	ADOT Construction Group
Tao Fong	ADOT Roadside Development
Estomih (Tom) Kombe	ADOT Research Project Manager

SPR-589, *Determination of 404 Permit and Habitat Restoration Requirements*

Research Agency:	EcoPlan Associates, Inc.	FY Authorization:	2005
Principal Investigator(s):	George A. Ruffner, Ph.D.	Contract Date:	04/27/2007
Contract Amount:	$110,558	Original Completion Date:	06/30/2008
Program Budget:	$125,000	Estimated Completion Date:	09/30/2010
Expenditures to date:	$99,331	Is project on schedule?	No
Available Amount:	$11,227	ADVANTAGE No.	R058917P
Percent complete	95%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

ADOT recognizes that with the construction of highway projects and to waters of the U.S. and important habitat areas that there is an opportunity to re-establish and enhance quality wildlife habitat areas. The present Permits frequently require planting on a replacement of 3 to 1 with up to 80% survival in the fifth year of the permit. Based on review of these permit areas it is becoming apparent that these requirements are beyond a naturally sustainable level with a number of projects falling short of these requirements. Since habitat and native planting has not been studied these criteria are based on assumptions beyond what the various ecological systems appear to be able to support especially in a drought.

The present 7-year drought that we are experiencing has a very direct effect on the survivability of the plantings. At the present time no one area can provide information from which to make evaluations and determinations which would provide a basis for new project plantings and specifications. Values that are appearing with projects require additional time and effort of the various staff resources in setting up new projects and addressing value issues.

The resulting benefits would include the following:

- ADOT will be able to develop guidelines that recognize most successful species for planting for habitat restoration.
- Restoration of areas has a benefit not only to wildlife but also from a visual standpoint of the highway traveler.
- Development of guidelines would establish some uniformity and a basis for negotiations for 404 Permits (Clean Water Act, Section 404, regulating waste discharges to Waters of the United States) and habitat replacement with other agencies.
- At the present time with values on existing projects, replanting is expensive and may be non-productive.

RESEARCH OBJECTIVES

1. Identify Section 404 permits and habitat restoration requirements for ADOT projects that are under construction and within the reporting period for completion (3 to 5 years).

2. Assess the progress of the mitigation plantings towards meeting the section 404 permit habitat restoration mitigation requirements.
3. Determine what plant species and 5-year density levels are reasonable and sustainable as related to reference plot conditions in nearby undisturbed habitats.
4. Develop criteria and guidelines for habitat establishment or replacement suitable for ADOT use in mitigation areas required by section 404 permits or for similar planting efforts that may be required by other agencies.

EXPECTED IMPLEMENTATION

At the present time we estimate ADOT spends over several thousand dollars a year for plantings on various projects throughout the state. Evaluations 3 or 4 years after these plantings are being made are beginning to indicate that many of these plantings are being made beyond the naturally sustainable level. The research would provide additional direction to the Department on realistic expectations and commitments.

STATUS OF THE RESEARCH

This project is completed except for final internal format review and publication.

TECHNICAL ADVISORY COMMITTEE (TAC)

LeRoy Brady	ADOT Roadside Development (Champion)
Vicki Bever	ADOT Natural Resources
Michael Daehler	ADOT Environmental Planning Group
Steve Thomas	FHWA Arizona Office
Mathew Moul	ADOT Globe District
Ted Littlefield	ADOT Construction Group
Tao Fong	ADOT Roadside Development
Estomih (Tom) Kombe	ADOT Research Project Manager

SPR-600, *Effectiveness of Microbe Application to Petroleum Spills at Crash Sites*

Research Agency:	N Weiss Associates, Inc.	FY Authorization:	2005
Principal Investigator(s):	Norm Weiss	Contract Date:	04/04/2006
Contract Amount:	$15,000	Original Completion Date:	06/2008
Program Budget:	$15,000	Estimated Completion Date:	09/30/2010
Expenditures to date:	$12,600	Is project on schedule?	Yes
Available Amount:	$2,400	ADVANTAGE No.	R060017P
Percent complete	70%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Hundreds of private and commercial vehicles crash on ADOT roadways yearly, often releasing fuel tank and engine contents onto ADOT property. This may result in soil contamination above regulatory action levels. Runoff from roadways is a nationally recognized storm water quality threat, prompting the California Department of Transportation, for example, to build extensive storm water protection devices. Storm water quality issues at ADOT have been addressed by a consent decree from ADEQ.

Petroleum releases from crashes pose a threat to storm water quality (both natural rain and runoff from fire departments at the crash site) and adjacent soils. One method commonly used to mitigate petroleum-contaminated soils is the application of petroleum-eating microbes to affected areas. ADOT would benefit from a research project, which would begin to answer these questions:

1. What environmental benefit, as measured by standard soil testing, might ADOT expect to obtain from applying a microbe solution to crash site spills as part of our first response to the incident?
2. How much would it cost to equip ADOT response teams to apply microbe solution?

The TRIS database contains 97 abstracts on storm water topics and 2 abstracts on petroleum contaminated soils. The Research in Progress database contains 43 abstracts on storm water topics and 1 on petroleum-contaminated soils. None were found that examined the impact of microbe application on a per-release (per crash, in this case) basis.

RESEARCH OBJECTIVES

1. Assess the effectiveness of microbe application by analyzing treated and untreated samples in a controlled field environment.
2. Determine the cost per response vehicle of preparing teams to apply microbe solution.
3. If applicable, recommend one or more microbe products for use by first response teams.

At a minimum the following tasks will be undertaken:

- Meet with project TAC to review the scope of work and work plan.
- Review the existing literature on microbe application, including asking microbe product manufacturers for input on applicable research.
- Select a research site or sites as necessary.
- Prepare, maintain, sample, and clean up test plots
- Prepare a detailed final report.
- Present results to the Research Council.

EXPECTED IMPLEMENTATION

The research will provide data that will enable the Agency to decide if it is cost effective to provide crash response teams with microbe application capability. Process owner of the study would be the Safety and Health Section. If implemented, the microbe application process would be owned by local maintenance groups/teams.

STATUS OF THE RESEARCH

Status: This project is completed except for final internal tech editing, format review, and publication.

TECHNICAL ADVISORY COMMITTEE

Travis Qualls	ADOT Safety and Health (Champion)
Courtney Perrier-Bear	ADOT Emergency Response
Steve Thomas	FHWA Arizona Office
Danny Peterson	ASU Environmental Technology Management
Estomih (Tom) Kombe	ADOT Research Project Manager

SPR-603*, Evaluation of Measures to Minimize Wildlife-Vehicle Collisions & Maintain Wildlife Permeability – Kohls Ranch Section, State Route 260*

Research Agency:	Arizona Game and Fish Department	FY Authorization:	2006
Principal Investigator(s):	Ray Schweinsburg	Contract Date:	11/10/2005
Contract Amount:	$166,313	Original Completion Date:	06/30/2008
Program Budget:	$166,313	Estimated Completion Date:	09/30/2010
Expenditures to date:	$157,908	Is project on schedule?	Yes
Available Amount:	$8,405	ADVANTAGE No.	R060318P
Percent complete	95%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Under Phase I (2004-2004) of the SR 260 research project we recorded 4,001 animals with video camera systems at the 1st 2 underpasses (UP), comparing use (e.g., 68% passage rate) and behavioral response. Based on this data, ADOT made major design changes to the UP on the Kohls Ranch (KR) Section. We accrued 101,500 fixes from 33 elk fitted with GPS satellite tracking collars, and identified 3,057 highway crossings and assessed permeability. This data was used to determine the extent of elk-proof fencing needed to intercept and funnel elk to UP, maximizing UP effectiveness. In the KR Section, adding fencing to 25% of the section is projected to intercept 60% of the elk crossings. We compared GPS crossings to nearly 500 wildlife-vehicle collisions (WVC) from 1994-2004, and compared collisions before and after highway reconstruction. Under Phase II (2004-2006), we've fitted 29 elk and 7 whitetail deer with GPS collars. Video surveillance has been ongoing at 4 UP on the Christopher Creek (CC) Section since 2004, with 1,158 animals recorded; passage rates have been low (23%). With additional UP video assessment, we will be able to conduct multivariate analysis of factors affecting wildlife use and UP effectiveness and assess long-term changes in usage. This project will provide long-term data on wildlife use of UP and permeability, as well as assess the effectiveness of adaptive management changes made on the KR Section.

In summary, project benefits include - 1) Highway safety - WVC reduction, 2) enhanced long-term research and insights for future application, 3) increased effectiveness of wildlife measures, 4) enhanced standing for ADOT on liability issues involving WVC, 5) enhanced decision making on future highway applications, 6) continued commitment to sound project management principals, 7) national leadership in innovative application of UP.

RESEARCH OBJECTIVES

1) Analyze collisions to assess effectiveness of UP and fencing in reducing WVC, 2) install video camera system to assess wildlife use of the new KR Section UP, 3) fit 6 elk with GPS collars on the KR Section, and track those collared in Phase II to assess elk permeability after reconstruction, 4) continue to monitor the 6 UP with video systems already in place to yield long-term data, and 5) continue to work closely with ADOT managers to improve the effectiveness of wildlife measures.

EXPECTED IMPLEMENTATION

The results of our management-oriented research will support ongoing adaptive management with ADOT to develop and implement effective UP structures and determine fencing needs. Insights from this research will be used to develop guidelines for future underpasses.

STATUS OF THE RESEARCH

Status: This project is completed except for final internal format review and publication.

TECHNICAL ADVISORY COMMITTEE

Bruce Eilerts	ADOT Natural Resources (Champion)
Doug Brown	Arizona Dept. of Administration
Jeff Gagnon	Arizona Game and Fish Dept.
Norris Dodd	Arizona Game & Fish Dept. (retired)
Ray Schweinsburg	Arizona Game & Fish Dept.
Steve Thomas	FHWA Arizona Office
Terry Brennan	Tonto National Forest
Estomih (Tom) Kombe	ADOT Research Project Manager

SPR-626, *State Route 64 Wildlife Accident Reduction Study Monitoring*

Research Agency:	Arizona Game and Fish Department	FY Authorization:	2007
Principal Investigator(s):	Ray Schweinsburg	Contract Date:	07/27/2007
Contract Amount:	$195,600	Original Completion Date:	06/30/2010
Program Budget:	$195,600	Estimated Completion Date	06/30/2011
Expenditures to date:	$132,281	Is project on schedule?	Yes
Available Amount:	$63,319	ADVANTAGE No.	R062619P
Percent complete	85%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Highways cause direct mortality to wildlife from wildlife-vehicle collisions (WVC) and create barriers to crossing animals. With increasing motorist use of Arizona's rural highways, these impacts are intensifying, as are safety and property damage concerns with WVC. For State Route (SR) 64, the main highway access to the Grand Canyon, a proactive Wildlife Accident Reduction Study was completed in 2006. This study addressed the high incidence of WVC along 50 miles of this high traffic volume highway; WVC accounted for 48% of all accidents from 1998-2003. This purpose of the study was to identify and evaluate alternatives to reduce WVC (and enhance permeability) for incorporation into a feasibility study being developed for the reconstruction of SR 64; this study identified numerous sites for future passage structures. However, this report also identified interim monitoring needs to provide information or address questions in support of the feasibility study and future reconstruction.

RESEARCH OBJECTIVES

To address the monitoring needs in the SR 64 Wildlife Accident Reduction Study, the research objectives of this proposed project include:

1. Assess elk, mule deer, and pronghorn movements, highway crossing patterns, and distribution relative to SR 64 and determine permeability across the highway corridor,
2. Investigate the relationships of elk, mule deer, and pronghorn highway crossing and distribution patterns to vehicular traffic volume along SR 64,
3. Assess the degree to which the existing Cataract Canyon Bridge is currently used by wildlife for below-grade passage,
4. Investigate wildlife-vehicle collision patterns along SR 64 and relationships to elk, mule deer, and pronghorn movement and highway crossing patterns,
5. Assess the degree to which SR 64 and other northern Arizona highways have affected gene flow and genetic diversity among pronghorn populations (NOTE: this is an OPTIONAL objective dependent on additional funding), and

6. Develop recommendations to enhance elk, mule deer and pronghorn highway permeability though the application of wildlife passage structures and ungulate-proof fencing.

EXPECTED IMPLEMENTATION

The results will be used to refine plans for reconstruction of SR 64 to meet wildlife passage and permeability as part of the feasibility study being conducted, as well as be incorporated into scientific journal manuscripts and compliment wildlife-highway research collected elsewhere in Arizona.

STATUS OF THE RESEARCH

Status: This project is nearing completion with a draft final report soon to be submitted to the TAC for their review and comments. The project should be completed by June 30th, 2011.

TECHNICAL ADVISORY COMMITTEE (TAC)

John Harper	ADOT Flagstaff District Engineer
Justin White	ADOT Flagstaff District – Environmental Planning
Ray Schweinsburg	Arizona Game and Fish Dept.
Jeff Waters	U.S. Forest Service, Kaibab NF
Steve Thomas	FHWA Arizona Office
Estomih (Tom) Kombe	ADOT Research Project Manager

SPR-647, *Elk Movements Associated with a High-Traffic Highway: Interstate-17*

Research Agency:	Arizona Game and Fish Department	FY Authorization:	2008
Principal Investigator(s):	Ray Schweinsburg	Contract Date:	02/04/2008
Contract Amount:	$250,000	Original Completion Date:	10/31/2011
Program Budget:	$250,000	Estimated Completion Date:	10/31/2011
Expenditures to date:	$122,944	Is project on schedule?	Yes
Available Amount:	$127,055	ADVANTAGE No.	R064720P
Percent complete	70%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Wildlife-vehicle collisions (WVC) cause tremendous property damage, human injuries and deaths, and substantial mortality to wildlife. Highways present barriers to the free movement of wildlife from reduced permeability and can fragment and isolate populations. Insights gained from ATRC-funded research along State Route (SR) 260 (Dodd et al. 2007) illustrated the impact of highway reconstruction on WVC and elk permeability, as well as the benefit (to safety, wildlife, and economics) of mitigation measures such as underpasses and fencing to reduce WVC and promote elk permeability. This study also shed light on the relationships to vehicular traffic volume to wildlife passage. Traffic on SR 260 (< 9,000 AADT) only occasionally posed a barrier to elk during peak volume periods. A small proportion of the elk (22%) crossed the highway frequently (>0.4 crossings/day), yet accounted for 87% of the collisions with vehicles.

WVC along Interstate-17 (I-17) present a significant safety and liability concern, particularly those involving elk between MP 310-325 where WVC constitute the single greatest cause of crashes. ADOT funded an ongoing pilot study assessment of elk movements and permeability here in 2005. Preliminary results of this study show that I-17 presents a significant barrier to wildlife passage compared to SR 260, owing to its high traffic volume (>17,500 AADT); we suspect that like SR 260, relatively few elk account for most accidents, though our small sample size has yet to include such elk. The potential exists in working with the ADOT Flagstaff District to address the incidence of WVC through fencing that will link existing structures (e.g., bridges and large box culverts) to create wildlife passages, which may also improve wildlife permeability as done on SR 260. Research here will complement that done on SR 260 and provide valuable insights into the impact of high traffic volumes on wildlife (heretofore only theoretical) and ability to mitigate highway impact under such traffic volumes.

RESEARCH OBJECTIVES

This project will continue and expand upon a pilot elk movements study ongoing since 2005. Objectives include:

1) Assess elk movements, distribution, and crossing patterns, and assess elk permeability by GPS telemetry,

2) Investigate the relationships of elk crossing and distribution patterns to traffic volume (using a newly installed traffic counter),
3) Validate and refine our model assessing the influence of various environmental parameters developed for SR 260,
4) Investigate wildlife-vehicle collision patterns, and
5) Develop recommendations for the retrofitting of existing and reconstruction of new wildlife passage structures and other mitigations to reduce WVC and promote permeability.

EXPECTED IMPLEMENTATION

The results of this project will be used by the ADOT Flagstaff District to develop short-term strategies to reduce WVC and promote wildlife permeability along I-17 through fencing of high incidence elk crossing zones and collision hotspots. The results will also be integrated into design concept planning for future reconstruction.

STATUS OF THE RESEARCH

Status: This project is on-going and should be completed by October 31st, 2011 per schedule amendment currently in process.

TECHNICAL ADVISORY COMMITTEE (TAC)

Todd Williams	ADOT Environmental Services (Champion)
John Harper	ADOT Flagstaff District (Sponsor)
Justin White	ADOT Flagstaff District – Environmental Planning
Sreelatha Gajula	ADOT Traffic Group
Chuck Howe	ADOT Flagstaff District
Steve Thomas	FHWA
Siobhan Nordhaugen	ADOT Natural Resources
Ray Schweinsburg	Arizona Game and Fish Dept. Research Branch
Chris Fetzer	Northern Arizona Council of Governments (NACOG)
Henry Provencio	US Forest Service
Estomih (Tom) Kombe	ADOT Research Project Manager

SPR-650*, Predicting Desert Tortoise (Gopherus agassizzii) Habitat and Identifying Movement Patterns within the Proposed Highway 95 Realignment*

Research Agency:	Arizona Game and Fish Department	FY Authorization:	2008
Principal Investigator(s):	Ray Schweinsburg	Contract Date:	02/04/2008
Contract Amount:	$346,000	Original Completion Date:	06/30/2011
Program Budget:	$346,000	Estimated Completion Date:	06/30/2011
Expenditures to date:	$311,000	Is project on schedule?	Yes
Available Amount:	$35,000	ADVANTAGE No.	R065020P
Percent complete	85%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

State Route 95 has been proposed for expansion through one of the important desert tortoise Key Habitat Areas (KHA) within the State, and could irreversibly fragment the area if not properly placed and designed. Preliminary work within the KHA suggests a correlation between tortoise activity and Aridisol soil types, and shows promise as a tool to assist in proper placement of the new highway. Without this tool biologists lack the ability to predict and quantify important tortoise areas, and therefore fully assess the threat from the proposed Highway 95 project. Once proper placement of the alignment is determined, specific crossing structures to facilitate safe tortoise passage is needed. Two general variables are critical to the success of wildlife crossings: location and design. To determine the number and location of crossing structures, tortoise movement patterns must be understood prior to highway design. Finally, the proper type of crossing structures must be incorporated at each previously identified location so as to ensure an effective wildlife mitigation package for this highway project.

RESEARCH OBJECTIVES

1. Develop and validate a soil-based predictive model for desert tortoise occupancy to quantify potential impacts from proposed SR 95, and to recommend specific placement of the alignment
2. Using GPS tracking devices, identify areas along the proposed SR 95 realignment for the potential placement of underpass structures to facilitate safe tortoise passage
3. Determine effectiveness of existing crossing structures and associated fencing constructed to facilitate the crossing of desert tortoises on Highway 93, and;
4. Provide insight (management recommendations) for improvement and assess feasibility of similar mitigation for proposed Highway 95 project in the Black Mountain area.

EXPECTED IMPLEMENTATION

This project will help ADOT with compliance issues relevant to this sensitive species. Results for this project will allow for roadway designers to place the new highway 95 realignment in an

area that has the least impact on desert tortoises, thereby reducing any possible delays caused by litigation. In addition, results from this study will allow for the most efficient placement of roadway underpasses for desert tortoises, potentially saving dollars from arbitrarily placing structures where they are not needed.

STATUS OF THE RESEARCH

Status: This project is ongoing and should be completed by June 30th, 2011.

TECHNICAL ADVISORY COMMITTEE (TAC)

Julie Alpert	ADOT Kingman District Environmental Coordinator (Champion, co-sponsor)
Victor Yang	ADOT Roadway Predesign Manager (co-sponsor)
Michael Ingraldi	Arizona Game and Fish Dept.
Siobhan Nordhaugen	ADOT Natural Resources
Mike Kondelis	ADOT Kingman District Engineer
Ray Schweinsburg	Arizona Game and Fish Dept, Research Branch
John Reid	US BLM – Kingman
Steve Thomas	FHWA
Estomih (Tom) Kombe	ADOT Research Project Manager

SPR-659*, Genetic Variation of Pronghorn across US Highway 89 and State Route 64*

Research Agency:	Northern Arizona University	FY Authorization:	2008
Principal Investigator(s):	Dr. Tad C. Theimer	Contract Date:	05/07/2008
Contract Amount:	$15,000	Original Completion Date:	03/31/2010
Program Budget:	$15,000	Estimated Completion Date:	12/31/2010
Expenditures to date:	$3,750	Is project on schedule?	Yes
Available Amount:	$11,250	ADVANTAGE No.	R065920P
Percent complete	85%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Based on behavioral observations, the barrier effect from highways is likely greater on pronghorn than most other large mammal species, including bighorn. During extensive VHF-telemetry studies in northern Arizona over several years, Richard Ockenfels and colleagues with the Arizona Game and Fish Department never documented a successful pronghorn crossing of a paved and fenced highway. Relatively recent population bottlenecks in northern Arizona combined with the separation caused by roads and associated right-of-way fencing may indicate an even more dramatic level of isolation than those identified by Epps and colleagues for bighorn in 2005. Genetic markers to determine the effect of highways on pronghorn genetics have already been developed, but have not been used in this context.

Given the degree to which highways are known to block pronghorn movements, the depressed nature of current pronghorn populations in northern Arizona and the fact that U.S. Highway 89 and State Route 64 will be reconstructed in the future to accommodate increasing volumes of traffic, the challenge before us is to determine if and how pronghorn populations in northern Arizona can be reconnected to maintain population viability into the future. Information gained from this research may help justify the implementation of such passage structures to accommodate pronghorn movement.

RESEARCH OBJECTIVES

The objective of this study is to determine whether genetic samples collected from pronghorn on opposite sides of US89 and SR64 indicate greater genetic difference than expected if the highway were not acting as a barrier to movement. Specific tasks will include;

1) Extract DNA from pronghorn samples collected by AZGFD personnel along US 89 and SR 64.
2) Analyze those samples using microsatellite markers to determine whether populations on opposite sides of the highway are more genetically distinct than expected if the highway were not acting as a barrier to movement.
3) To prepare annual and final written reports interpreting the results of our genetic analysis and whether they support the hypothesis that highways have resulted in genetic differentiation.

EXPECTED IMPLEMENTATION

Information gained from this project will document the potential for highways to genetically isolate pronghorn populations. These data will inform decisions about the feasibility and importance of mitigating highway upgrades via measures such as population augmentation or creating crossing opportunities for pronghorn across Arizona roadways.

STATUS OF THE RESEARCH

Status: This project is nearing completion with TAC review completed. It should be completed by September 30th, 2010.

TECHNICAL ADVISORY COMMITTEE (TAC)

Justin White	ADOT Flagstaff District – Environmental Services (Champion)
John Harper	ADOT Flagstaff District (Sponsor)
Chuck Howe	ADOT Flagstaff District – Environmental Services
Sreelatha Gajula	ADOT Traffic Group
Cary Thompson	U.S. National Forest Service
Pamela Kyselka	Navajo Fish and Wildlife
Steve Thomas	FHWA
Ray Schweinsburg	Arizona Game and Fish Dept. Research Branch
Estomih (Tom) Kombe	ADOT Research Project Manager

SPR-677*, Evaluation of Measures to Promote Desert Bighorn Sheep Highway Permeability: US Highway 93*

Research Agency:	Arizona Game and Fish Dept. – Research Branch	FY Authorization:	2009
Principal Investigator(s):	Ray Schweinsburg	Contract Date:	02/13/2009
Contract Amount:	$185,000	Original Completion Date:	09/30/2011
Program Budget:	$185,000	Estimated Completion Date:	09/30/2011
Expenditures to date:	$18,899	Is project on schedule?	Yes
Available Amount:	$162,900	ADVANTAGE No.	R067721P
Percent complete	35%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

One of the most pervasive impacts of highways on wildlife is the barrier effect that results in diminished habitat connectivity and permeability. Highways block animal movements between seasonal ranges or other vital habitats, fragment habitats and populations, reduce genetic interchange, and disrupt viable population processes. Recent research on desert bighorn sheep movements and crossing patterns adjacent to US 93 point to the barrier created by this highway through the largest bighorn sheep populations in Arizona, as well as the impact of bighorn-vehicle collisions. US 93 (MP 2-17) is planned for reconstruction from a 2-lane to a 4-lane divided highway beginning in either late 2008 or early 2009. Concerns exist that this reconstruction could further fragment bighorn habitat and contribute to increased bighorn-vehicle collisions. Wildlife passage structures have shown benefit in promoting passage for a variety of wildlife species, have reduced the incidence of wildlife-vehicle collisions, and yielded substantial economic benefit. As such, the Arizona Department of Transportation (ADOT) plans to construct 3 wildlife overpasses (the first in the state) with fencing linking the structures to promote bighorn permeability across the US 93 corridor. This represents a tremendous commitment on the part of ADOT and warrants thorough evaluation to assess the efficacy of overpasses in promoting permeability, particularly since few overpasses exist in North America. To assess the efficacy of the planned US 93 wildlife overpasses in promoting permeability, it is necessary to compute bighorn passage rates as an objective metric, comparing passage rates before (phase I; 2 years, before and during construction) and after construction of the planned passage structures is completed (phase II; 2 years, future funding). This funding request covers phase I. It is anticipated that once completed, wildlife use of the overpasses will be monitored by video surveillance.

RESEARCH OBJECTIVES

This proposed research project will add greatly to our understanding of desert bighorn sheep-highway relationships and the effectiveness of planned overpasses to promote permeability. Specific objectives include assessing:

(1) Desert bighorn sheep movement and highway crossing patterns, and calculate permeability across the highway corridor before and after overpasses are constructed;

(2) Spatial and temporal relationships of bighorn highway crossing patterns to vehicular traffic volume;
(3) Wildlife-vehicle collision patterns;
(4) Impact of highway construction activities on bighorn sheep; and
(5) Wildlife use of wildlife overpasses and jump-outs.

EXPECTED IMPLEMENTATION

The results of this project will validate the benefit of overpasses in promoting bighorn permeability, and will be used by highway and wildlife departments across North America to address wildlife permeability. The results and insights will also be integrated into design concept planning for future highway reconstruction as well as new construction.

STATUS OF THE RESEARCH

Status: This project is ongoing with good progress.

TECHNICAL ADVISORY COMMITTEE (TAC)

Julie Alpert	ADOT Kingman District –Environmental Coordinator (Champion)
Michael Kondelis	ADOT Kingman District Engineer - (Sponsor)
Ray Schweinsburg	Arizona Game and Fish Dept. Research Branch
Siobhan Nordhaugen	ADOT OES – Natural Resources
Steve Thomas	FHWA
Trevor Buhr	Arizona Game and Fish Dept.
John Reid	U.S. Bureau of Land Management
Jim Holland	U.S. National Park Service
Ross Haley	U.S. National Park Service
Jerry Hickman	U.S. Bureau of Reclamation
Estomih (Tom) Kombe	ADOT Research Project Manager

SPR-689*, Performance Evaluation of a Highway Retrofit for Wildlife: I-17 Munds Park to Woods Canyon*

Research Agency:	Pending	FY Authorization:	2010
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Original Completion Date:	Pending
Program Budget:	$170,000	Estimated Completion Date:	Pending
Expenditures to date:	$0	Is project on schedule?	N/A
Available Amount:	$170,000	ADVANTAGE No.	R068922P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

Interstate-17 is the primary route connecting Phoenix to Flagstaff and is the main artery serving northern Arizona and supporting the transport of goods along I-40 to the east and west. Interstate-17 is traveled by millions of tourists each year visiting area national parks (NP) and recreation areas, including the Grand Canyon NP, Petrified Forest NP, Sunset Crater National Monument, Glen Canyon Recreation Area, etc. As Arizona continues to grow, traffic on I-17 will also increase. This stretch of highway is considered one of the highest elk-vehicle collision areas in Arizona; the majority of these collisions (97%) occur between Stoneman Lake Road and Flagstaff. Further, I-17 is considered a very high volume highway, and as such, is predicted to pose a significant barrier to wildlife (Mueller and Berthoud 1997). Wildlife passage structures have shown benefit in promoting passage for a variety of wildlife species, have reduced the incidence of wildlife-vehicle collisions, and yielded substantial economic benefit (Dodd et al. 2007). As such, ADOT has committed funds to support a SAFETEA-LU project that will link existing bridges and transportation interchanges to reduce elk-vehicle collisions and promote permeability across the I-17 corridor. This represents a tremendous commitment on the part of ADOT and warrants thorough evaluation to assess the efficacy of this fencing in promoting permeability, particularly since few retrofit opportunities have been attempted and can lead to future cost-savings and accident reductions for many highways throughout Arizona and the rest of the nation. Research here will also complement that ongoing on SR 260, I-17, US 89, SR 64, and Interstate 40 and provide valuable insights into wildlife-highway interactions for a range of wildlife and approaches to mitigate highway and traffic impacts.

RESEARCH OBJECTIVES

Specific objectives include assessing:

1. Elk movement and highway crossing patterns, including calculating permeability across the highway after fencing is constructed to compare to movement patterns and permeability evaluated during pre fencing research;
2. Movements of wildlife through the bridges and transportation interchanges; and
3. Wildlife-vehicle collision patterns following implementation of fencing.

EXPECTED IMPLEMENTATION

The results of this project will validate the benefit of a "retrofit" of existing structures in reducing elk-vehicle collisions while promoting elk permeability, and will be used by highway and wildlife departments across North America to address wildlife permeability. The results and insights will also be integrated into design concept planning for future highway reconstruction as well as similar potential opportunities throughout AZ. This project will begin immediately following the installation of SAFETEA-LU/ Flagstaff District funded elk fencing and escape mechanisms.

STATUS OF THE RESEARCH

Status: Pending. Project work should start this summer or early fall and run for 3 years per current schedule.

TECHNICAL ADVISORY COMMITTEE (TAC)

Siobhan Nordhaugen	ADOT Natural Resources(Champion)
John Harper	ADOT Flagstaff District, Project Sponsor
Chuck Howe	ADOT Flagstaff District – District Environmental Coordinator
Ray Schweinsburg	Arizona Game and Fish Department
Estomih (Tom) Kombe	ADOT Research Project Manager

Additional TAC membership: Pending.

SPR-696, *SB2010-34: A Preliminary Study of Climate Adaptation Issues for the Statewide Transportation System in Arizona*

Research Agency:	Pending	FY Authorization:	2010
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Original Completion Date:	Pending
Program Budget:	$25,000	Estimated Completion Date:	Pending
Expenditures to date:	$0	Is project on schedule?	N/A
Available Amount:	$25,000	ADVANTAGE No.	
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Tom Kombe

PROBLEM STATEMENT

The effects of climate change upon a statewide transportation system will impact the decision making process for the entire transportation agency. Addressing the need for adaptation to climate change impacts will demand, among other things, the development of green house gas emission mitigations and putting in place organizational climate adaptation strategies and procedures. This study can serve to identify the areas of vulnerability to climate change, and the elements of an organizational strategy for adaptation within the transportation system. The study will establish an avenue for input from all key players in developing a statewide transportation climate adaptation strategy.

RESEARCH OBJECTIVES

1. Identify areas of vulnerability to climate change.
2. Develop an outline for adaptation to transportation climate change impacts at a statewide level.
3. Develop an ADOT agency wide education and dialogue on climate change adaptation.

EXPECTED IMPLEMENTATION

The team will prepare an executive summary for ADOT distribution that will outline the findings. The product will be formatted as an E-publication for web and newsletter postings. It is expected that review of the finding will lead to other projects such as establishing a climate adaptation database, identifying and mapping climate vulnerable transportation infrastructure, and communication with other statewide agencies concerning infrastructure climate adaptation and ecosystems.

STATUS OF THE RESEARCH

Status: Pending. Project work should start in the summer or early fall of 2010.

Environment

TECHNICAL ADVISORY COMMITTEE (TAC)

Charles M Beck	ADOT Office of Environmental Services(Champion)
Thor Anderson	ADOT Office of Environmental Services (Sponsor)
Mary Frye	FHWA Arizona Office
Ed Stillings	FHWA Arizona Office
Michael Traubert	ADOT Office of Environmental Services
Beverly Chenausky	ADOT Multimodal Planning Division, Air Quality
Estomih (Tom) Kombe	ADOT Research Project Manager

Additional TAC membership: Pending.

Intelligent Transportation Systems (ITS) – PROJECTS

SPR-604, *Real-time Adaptive Ramp Metering: Phase 2 – Implementation and Enhancement*

Research Agency:	University of Arizona	FY Authorization:	2006
Principal Investigator(s):	Dr. Larry Head	Contract Date:	01/19/2007
Contract Amount:	$200,000	Original Completion Date:	06/30/2010
Program Budget:	$200,000	Estimated Completion Date:	06/30/2010
Expenditures to date:	$174,567	Is project on schedule?	Yes
Available Amount:	$25,433	ADVANTAGE No.	R0604 18P
Percent complete	64%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

ADOT's Freeway Management System (FMS) is designed for "smart" ramp metering, considering the ramp impacts on mainline traffic flow, but real-time traffic-adaptive metering has never effectively been deployed. New FMS upgrades will allow full utilization of control strategies, such as University of Arizona's MILOS program, to smooth traffic flows and improve regional operations. Phase 1, the recent SPR 595 research, was the "proof of concept" for integration of existing ADOT systems with new traffic management programs and firmware, so that the optimum metering rates, as determined by MILOS, can be downloaded to the ramps.

This new Phase 2 project will implement MILOS, evaluate its operation, and identify required operational enhancements. It will deploy MILOS as an operational prototype system that can be field tested by ADOT operations staff to more efficiently manage freeway corridor operations.

RESEARCH OBJECTIVES

The new Phase 2 effort will evaluate the performance of MILOS in field operational conditions. Initially, MILOS will be operated in "shadow mode" to observe functionality, and to identify strengths and weaknesses as well as any needed enhancements. Solutions will be developed to address needs and deficiencies, tested using simulation, and implemented in the operational system. The program will then be run on-line to develop data to compare and evaluate both the "MILOS-ON" and "MILOS-OFF" performance.

EXPECTED IMPLEMENTATION:

This research, for the first time, would fully utilize technologies and capabilities that are already available in the existing ADOT ramp metering system, which is available for "smart" ramp metering, but was never configured to do so. A new traffic-adaptive ramp metering system will be incorporated into ADOT's FMS operations.

Implementation could begin to occur within two years on a corridor-priority basis. Significant benefits to the regional freeway system would include a decrease in congestion, and increased

throughput on freeway networks, as well as improved efficiency and safety, reductions in resource consumption, and improved air quality.

STATUS OF THE RESEARCH

Four no-cost schedule extensions have been approved for this project, through 30 June 2010. Project is complete through integration test. Bench test, field test, and data analysis remain. 64% complete.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Scott E. Nodes	ADOT Transportation Technology Group / TOC Manager (Sponsor)
Darrell R. Bingham	ADOT Transportation Technology Group – TOC
Glenn S. Jonas	ADOT Transportation Technology Group – TOC
Lydia D. Warnick	ADOT Transportation Technology Group – TOC
Timothy M. Wolfe	ADOT Phoenix Maintenance District
Scott Orrahood	ADOT Traffic Engineering Group
Joe McGuirk	ADOT Phoenix Maintenance District
Sarath Joshua	Maricopa Association of Governments (MAG)
Faisal Saleem	Maricopa County DOT
Jim Decker	City of Tempe
Christine Warren	City of Tempe
John Siefert	City of Phoenix
Jennifer Brown	FHWA

SPR-627, *State-of-the-Art Evaluation of Traffic Detection and Monitoring Systems*

Research Agency:	Texas Transportation Institute	FY Authorization:	2007
Principal Investigator(s):	Dan Middleton	Contract Date:	02/12/2007
Contract Amount:	$68,125	Original Completion Date:	09/30/2009
Program Budget:	$200,000	Estimated Completion Date:	09/30/2010
Expenditures to date:	$124,414	Is project on schedule?	No
Available Amount:	$75,585	ADVANTAGE No.	R0627 19P
Percent complete	75%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

Accurate, complete and timely traffic data is critical to the effective management of the State's highway system. Limitations in current traffic monitoring abilities are an ongoing problem for ADOT, and for its customers as well, in both urban and rural areas. MAG, PAG, and ADOT's Multimodal Planning Division depend on detector data for planning purposes. If this data is not accurate, it may cost the state millions of dollars in federal funding. ADOT now spends about $50,000 per site to install detection, and another $1,000 per year to maintain each site. For 250 centerline miles of freeway, ADOT will invest roughly $25M to install traffic sensors and another $10M to maintain them over the 20-year life of the Regional Transportation Program.

RESEARCH OBJECTIVES

A number of technologies exist for detecting vehicles and determining volume, occupancy, and speed. Current technologies include buried loops, micro-loops, passive acoustic detectors, radar, and video detection. All have been used with varying degrees of success in different states.

This research will evaluate different non-intrusive technologies for traffic surveillance. The project will perform a state-of-the practice review of current technologies with the potential to more accurately monitor traffic volume, occupancy, and speed. This review will also include a literature search of recent and current research. The results will be specific recommendations in technology, software, and communications, and a conceptual test bed design, that conform to the basic ADOT goals, design constraints, data requirements, and budget limitations.

On this basis, the project will then develop the detailed design of a field test environment and evaluation program. Upon acceptance of the design, this project will support the establishment of the field evaluation test bed site, by others. Based upon this study's earlier recommendations, the most promising detector types will be deployed for an initial field-testing period, and the evaluation results will be documented in an ATRC final report.

EXPECTED IMPLEMENTATION

ADOT's entire freeway management operations mission in the major metropolitan areas is hampered by poor or missing data. The core data goals are impacted, including valid traveler information for the public, as well as valid traffic data for ADOT planning, for FHWA, and for partner agencies such as PAG, MAG, and AZTech. Effective new solutions for urban freeway management systems also will transfer to rural highway operations across the state. The results of this research and evaluation program will provide the basis for future planning and design of

ADOT's Freeway Management System (FMS). Local corridor testing of field-evaluated systems is a likely initial result of the study. If the tests are successful, then upgrades to FMS segments and to ADOT's rural ITI could follow, as funding allows.

STATUS OF THE RESEARCH

This project was scoped in three phases; the Texas Transportation Institute (TTI) has completed the initial two phases. These included a detection state of the practice study, a conceptual test bed site design, traffic-detector evaluation recommendations, and a site-specific design, evolving from the conceptual phase. By late 2007, TTI had completed the transition from the concept to a full test bed facility design.

After resolving issues regarding the facility budget, efforts were underway to complete a full design package, and to formally program facility funding from several ADOT partner sections.

As of April, 2009, all funding for construction of this project had been withdrawn and committed to another project. It is uncertain as to whether sufficient funds will be available in the new state Fiscal Year to allow completion of the project. The design is about 75% complete, but is now on hold pending resolution of budget issues. In the event that the project is able to proceed, a third phase, following construction, will include the planned evaluation of several candidate detector systems, for approximately 15 months, which may utilize the resources of both TTI and a local consulting team.

TECHNICAL ADVISORY COMMITTEE (TAC)

Scott E. Nodes	ADOT Technology Group / TOC (Sponsor/Champion)
Timothy M.. Wolfe	ADOT Phoenix Maintenance District (Co-champion)
Ryan W. Gish	ADOT Transportation Technology Group
Glenn S. Jonas	ADOT Transportation Technology Group
Farzana Yasmin	ADOT Transportation Technology Group
Lydia K. Warnick	ADOT Transportation Technology Group – TOC
Jon Lovell	ADOT Transportation Technology Group – TOC
Joe McGuirk	ADOT Phoenix Maintenance District
Chuck McClatchey	ADOT Phoenix Maintenance District
Girgis A. Girgis	ADOT Vision – ITS/FMS Construction
Mike Manthey	ADOT Traffic Engineering Group
Dave Duffy	ADOT Traffic Engineering Group
Doug Eberline	ADOT Multimodal Planning Division
Wang Zhang	Maricopa Association of Governments (MAG)
Leo Luo	Maricopa Association of Governments (MAG)
Paul Casertano	Pima Association of Governments (PAG)
Bruce Dressel	City of Scottsdale
Tom Kelley	Pima County DOT
Jim Decker	City of Tempe
Cdr. Tom Woodward	Arizona Department of Public Safety (DPS)
Kelly LaRosa	FHWA

SPR-634, *A Platform for Evaluating Emergency Evacuation Strategies*

Research Agency:	University of Arizona	FY Authorization:	2007
Principal Investigator(s):	Drs Yi-Chang Chiu & Larry Head	Contract Date:	03/09/2007
Contract Amount:	$100,000	Original Completion Date:	06/30/2010
Program Budget:	$100,000	Estimated Completion Date:	06/30/2010
Expenditures to date:	$97,824	Is project on schedule?	Yes
Available Amount:	$2176	ADVANTAGE No.	R0634 19P
Percent complete	98%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

The importance of transportation resources in emergency planning and response was proven in late 2005, with Hurricanes Katrina and Rita. During these events, deficiencies in the planning and execution of evacuation strategies were apparent. The real scenarios that occurred were far from the anticipated potential scenarios. Moreover, it is clear that existing public agency tools are limited in how well they can support real-time evacuation management.

A more comprehensive resource is needed that includes network and transportation services data and simulation tools to evaluate evacuation strategies and evacuee response. It would be a tool for emergency management personnel to better plan and execute evacuation procedures.

RESEARCH OBJECTIVES

This study will develop a robust platform to create evacuation strategies for Arizona. This resource will evolve through extensive regional data collection, supporting the development of viable simulation tools. The platform will be tested with diverse scenarios, and evacuation strategies will be developed, evaluated, and validated for each scenario. Key resources for the study include a Transportation Research Board web link for transportation security and evacuation research topics, and an FHWA website on emergency operations.

EXPECTED IMPLEMENTATION

This study will develop a platform to analyze and identify the best emergency response and transportation system management strategies for a variety of crisis evacuation scenarios that are directly relevant to Arizona.

The result will be a toolkit for development of operational and effective crisis evacuation plans and management strategies as required by ADOT, and for other partner agencies across the state. It will support internal and joint exercises and planning for critical situations - both those presently anticipated, and those that may evolve in the future.

STATUS OF THE RESEARCH

Draft final report is in final edit. 98% complete.

Intelligent Transportation Systems (ITS)

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Scott E. Nodes	ADOT Transportation Technology Group / TOC (Sponsor)
Becky Scott	Arizona Division of Emergency Management
Bill Hahn	Maricopa County DOT
Faisal Saleem	Maricopa County DOT
Leo Luo	Maricopa Association of Governments (MAG)
Sarath Joshua	Maricopa Association of Governments (MAG)
Gabe Thum	Pima Association of Governments (PAG)
Paul Casertano	Pima Association of Governments (PAG)
Kelly LaRosa	FHWA

SPR-645, *Automatic Vehicle Location (AVL) and Maintenance Work Effort Tracking*

Research Agency:	Arizona State University	FY Authorization:	2007
Principal Investigator(s):	Dr. Aaron Golub	Contract Date:	2/08/2008
Contract Amount:	$20,000 (ASU)	Original Completion Date:	9/30/2008
Program Budget:	$125,000 (all)	Estimated Completion Date:	9/30/2010
Expenditures to date:	$100,000	Is project on schedule?	No
Available Amount:	$25,000	ADVANTAGE No.	R0645 19P
Percent complete	10%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

Reliable communication with ADOT maintenance workers is a key management and safety concern, particularly in winter snowfighting efforts. The primary issues are operator safety, and tracking of crew work efforts for accurate reporting. ADOT must know where snowplows are along their routes, if and when those roads were plowed or treated with chemicals, and, at what rate. Environmental issues are also significant. Field managers must be able to document what, when, and how much anti-icing or de-icing chemical is applied along the State's roadways.

Automatic Vehicle Location (AVL) offers better, more timely data for pre-storm planning and for a prompt reaction to changing storm conditions. AVL can provide better information on road conditions for the media and the public. It can improve roadway de-icer usage, and management of stockpiles and plow equipment wear parts. GPS location data will improve driver safety, and by automating daily work records, can also reduce driver workload and stress, and improve their efficiency. More detailed and accurate AVL data will support ADOT against damage claims, and improve recordkeeping on environmental concerns.

The intent of this pilot AVL deployment is to receive, store, interpret, and utilize hard data in place of the hand-written operator reports from memory for a 12-hour plow shift. This hard data will provide a consistent picture of snowplow activity over the winter across the entire district, and a complete history for each route of the locations, events, and performance.

RESEARCH OBJECTIVES

Up to thirty snowplows across the Globe District will be equipped with AVL data systems as a regional pilot test for the 2007-08 winter, in the first effort to install AVL on all of a District's plow trucks. The system will be used on a variety of routes, to determine the extent, quality, and timeliness of the key plowing data needed for rural operations. It will also show if typical rural Arizona cellular service is sufficient to justify this technology, as tested across Globe District's diverse terrain.

EXPECTED IMPLEMENTATION

This research will determine the operational effectiveness of cellular AVL data systems for rural districts. A positive result will justify and support wider deployment of AVL data systems for Arizona's critical snowplowing operations, as well as for other types of heavy equipment.

STATUS OF THE RESEARCH

The ASU portion of this project is halted pending the return of the PI and negotiation of invoicing. 10% complete.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Jerry D. Barnes	ADOT Globe District Engineer (Sponsor)
Wayne Grainger	ADOT Globe District Maintenance Operations Superintendent (Champion)
Dennis Dodd	ADOT Globe District Maintenance, Globe Supervisor
Lane Hulbert	ADOT Globe District Maintenance, Roosevelt Supervisor
Lindy Sherrer	ADOT Globe District Maintenance, Show Low Supervisor
Clayton Bond	ADOT Globe District Maintenance, St. Johns Supervisor
Tony Castillo	ADOT Globe District Maintenance, Springerville Supervisor
Sandra Henson	ADOT Globe District Maintenance Analyst
John Trojanovich	ADOT Southern Region Equipment Manager
Alex C. Romero	ADOT Show Low Equipment Shop
John Wakefield	ADOT Central Fleet Equipment Services
Kelly LaRosa	FHWA

SPR-653, *Arizona VII Initiative: Proof of Concept/Operational Testing*

Research Agency:	University of Arizona w/ Arizona State University	FY Authorization:	2007
Principal Investigator(s):	Dr. Larry Head (UA), Dr. Pitu Mirchandani (ASU), Dr. Soyoung Ahn (ASU)	Contract Date:	2/07/2008
Contract Amount:	$165,000 / $35,000	Original Completion Date:	06/30/2010
Program Budget:	$200,000	Estimated Completion Date:	06/30/2010
Expenditures to date:	$170,820	Is project on schedule?	Yes
Available Amount:	$29,180	ADVANTAGE No.	R0653 19P
Percent complete	88%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

Vehicle Infrastructure Integration (VII) is the USDOT initiative to improve safety and mobility through enhanced roadside-to-vehicle and vehicle-to-vehicle communications and real-time information exchanges. Arizona is advanced in applying ITS technologies and in real-time information sharing among public agencies, but our networks are not currently adaptive to actual conditions on the roadways. Non-recurring congestion severely reduces mobility and operational efficiency of the urban area transportation network. Technology provides for adaptive network management, and VII explores how this can be implemented and integrated with legacy systems. Arizona will research potential VII applications and strategies to support enhanced incident management, and enhanced traffic control through real-time vehicle-to-roadside and vehicle-to-vehicle information sharing. Operations and safety – for incident responders as well as the traveling public - can be enhanced by real-time communications between network management systems and emergency response vehicles.

RESEARCH OBJECTIVES

The Emergency Vehicle focus of the pilot program has led to the "Arizona EVII" working title of this project. Phase 1 will develop and test potential incident management-specific applications: in-vehicle signing/displays, audible in-vehicle warnings, vehicle-to-roadside interfaces, roadside-to-center applications, and vehicle-to-vehicle communications.

Using outcomes of Phase I, the Phase II effort will test and research the successful applications in a pilot deployment. The Arizona EVII Phase II evaluation will assess functionality of the hardware and software, the human factors/responses, and the viability of the technology applications to support enhanced incident management. The project will demonstrate and identify interoperability requirements between new VII technologies and legacy systems. It is also intended to demonstrate enhanced safety benefits by improving real-time communications with emergency response vehicles, and real-time adaptive traffic management strategies.

EXPECTED IMPLEMENTATION

This study will provide an enhanced means of managing traffic based on real-time conditions, particularly for non-recurring incident congestion. In the future, response agencies will benefit from real-time vehicle information as sent to field devices, and to traffic operations centers. Further outcomes of this Arizona EVII research will include the proof of concept, prototype VII tools, human factors data, and significant inputs to the national VII effort.

STATUS OF THE RESEARCH

Both the University of Arizona and Arizona State University are performing elements of this project scope. The U of A is focused on E-VII technology and software development and the field demonstration scenarios, while ASU will perform the formal evaluation of the program's outcomes. UA will then complete the research report with ASU support. All testing and evaluation is complete. Cost-benefit report and final report are in preparation. 88% complete.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	**Affiliation**
Scott E. Nodes	ADOT Transportation Technology Group / TOC Manager (Champion)
Faisal Saleem	Maricopa County DOT (Co-champion)
Marty Scott	Maricopa County DOT (Co-champion)
Tom Mowery-Racz	ADOT TTG
Lydia D. Warnick	ADOT Transportation Technology Group – TOC
Jeff Jenq	City of Mesa
Jim Decker	City of Tempe
Jennifer Brown	FHWA

Other response partners:

- City of Phoenix Fire
- ADOT, Arizona Local Emergency Response Team (ALERT)
- Arizona Department of Public Safety (DPS)
- Maricopa County DOT (MCDOT), Regional Emergency Action Coordinating Team (REACT)
- *(with)* Program Support Consultants (MCDOT) – Kimley-Horn and Associates
- *(with)* EVII Coalition Vendor Partners: Econolite Systems

SPR-678, *Dynamic Routing for Incident Management*

Research Agency:	Kimley-Horn Associates	FY Authorization:	2009
Principal Investigator(s):	Doug Gettman	Contract Date:	Pending
Contract Amount:	$49,968	Original Completion Date:	06/30/2009
Program Budget:	$50,000	Estimated Completion Date:	12/31/2009
Expenditures to date:	$48,470	Is project on schedule?	No
Available Amount:	$1,498	ADVANTAGE No.	R0678 19P
Percent complete	96%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

Emergency responders must safely and rapidly navigate crowded roadways each day. Congestion, construction, and other factors often block the fastest and safest route to an incident scene. Real-time, robust and flexible routing tools are a critical need for both field response units and their dispatch staff.

RESEARCH OBJECTIVES

E-VII is an Arizona multi-agency program to apply *Vehicle-Infrastructure Integration* technology (*VII*) to critical Emergency services operations. The current ATRC Project SPR 653, *Arizona E-VII Proof of Concept and Operational Testing,* with ADOT and Maricopa County Department of Transportation (MCDOT) funding, uses roadside and on-board communications to share dynamic data among response units and traffic devices.

This new project will support Project SPR 653 by addressing key needs of emergency and dispatch personnel with enhanced decision support and detailed emergency route planning tools. The research will draw heavily from their pool of expertise to develop a conceptual plan for an intelligent vehicle routing system.

This study will augment the current E-VII demonstration project by giving responders better real-time dynamic route-planning resources to reach incident scenes faster and more safely. It will support similar activities at the national level in integrated communications for incident management and emergency response, and potentially expand these capabilities in the future to rural highways.

EXPECTED IMPLEMENTATION

Research results will be implemented in conjunction with application field testing and evaluation, as part of the project SPR 653 for the E-VII Proof of Concept, and in future activities.

The results will also be utilized by MCDOT and ADOT to evaluate potential enhancements or updates to state and regional traffic data systems.

STATUS OF THE RESEARCH

Draft final report is with TAC for final review after heavy ATRC revision. 96% complete.

Intelligent Transportation Systems (ITS)

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	**Affiliation**
Scott E. Nodes	ADOT Transportation Technology Group / TOC Manager (Champion)
Faisal Saleem	Maricopa County DOT (Co-champion)
Marty Scott	Maricopa County DOT (Co-champion)
Tom Mowery-Racz	ADOT TTG
Lydia D. Warnick	ADOT TTG – TOC
Jeff Jenq	City of Mesa
Jim Decker	City of Tempe
Jennifer Brown	FHWA

Other response partners:

- City of Phoenix Fire
- ADOT, Arizona Local Emergency Response Team (ALERT),
- Arizona Department of Public Safety (DPS),
- MCDOT, Regional Emergency Action Coordinating Team (REACT)
- *(with)* Program Support Consultants (MCDOT) – Kimley-Horn and Associates
- *(with)* EVII Coalition Vendor Partners: Econolite Systems

SPR-679*, Platform for Evaluating Emergency Evacuation Strategies – Phase II*

Research Agency:	Pending	FY Authorization:	2009
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Original Completion Date:	Pending
Program Budget:	$200,000	Estimated Completion Date:	Pending
Expenditures to date:	$0	On schedule?	N/A
Available Amount:	$200,000	ADVANTAGE No.	R0679 19P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

All emergency operational planning suffers from the inability to analyze, rehearse, and exercise responses to large scale incidents. The ideal operation plan must perform from the global scale, down to the entity/individual level; however, there is no current simulation capability to reliably test those plans. Realistic field exercises are impossible due to the cost and complexity of closing roads, civilian involvement, and area safety control, among other issues. Exercises attempted in the past employed unrealistic assumptions and were confined to artificial exercise areas, resulting in limited benefits to participants and flawed "lessons learned" that may increase the risk to public safety. It is imperative that the planning process for complex operations identify command and control options, intervention techniques, and responder actions to be inserted in real time into the simulation, and enable success or failure to be analyzed accurately and in depth. Working at this level of fidelity requires real-time inputs and outputs and geo-specific inter-visibility of movements. All of this must be effective down to the entity level - a capability that does not yet exist.

RESEARCH OBJECTIVES

This project, in the absence of suitable existing tools, will build on the Arizona Transportation Research Center's current project SPR-634, which has created a Phoenix-area database to fully employ the functionality of the new Multi-resolution Assignment and Loading of Transportation Activities (MALTA) modeling platform.

The objective is to develop a real-time, geo-specific, threat-specific simulation tool capable of replicating individual vehicle and person actions, responder actions, and unscripted operations initiatives.

EXPECTED IMPLEMENTATION

As ADOT's ability improves to examine plans that deal with large, complex operations, it will increase its capacity to better control high traffic flow durations, test and rehearse complex emergency response plans, and increase public safety. In addition to testing plans/strategies, the project will provide a tool for alleviating traffic congestion whether in new construction planning or planning for a large event.

If the developed platform works as well as anticipated, state emergency and traffic planners will make use of the models immediately as they are constructed.

STATUS OF THE RESEARCH

Project is not begun. Execution of dual draft JPAs is pending. 0% complete.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	**Affiliation**
Scott E. Nodes	ADOT Transportation Technology Group / TOC Manager (Sponsor)
Becky Scott	Arizona Division of Emergency Management
Bill Hahn	Maricopa County DOT
Faisal Saleem	Maricopa County DOT
Leo Luo	Maricopa Association of Governments (MAG)
Sarath Joshua	Maricopa Association of Governments (MAG)
Gabe Thum	Pima Association of Governments (PAG)
Paul Casertano	Pima Association of Governments (PAG)
Kelly LaRosa	FHWA

Others TBD

SPR-681, *Work Zone Instant Driver Warnings: Speed or Penalty Messages*

Research Agency:	Northern Arizona University	FY Authorization:	2009
Principal Investigator(s):	Craig Roberts	Contract Date:	8/14/2009
Contract Amount:	$62,500	Original Completion Date:	8/31/2010
Program Budget:	$62,500	Estimated Completion Date:	3/31/2011
Expenditures to date:	$0	Is project on schedule?	No
Available Amount:	$62,500	ADVANTAGE No.	R0681 19P
Percent complete	9%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

Excess speeds in construction work zones (as well as other zones, e.g., school, maintenance, etc.) cause safety problems to workers, pedestrians and vehicle drivers. Deployment of portable photo radar equipment is one current method of providing feedback to drivers as to their actual speed, but is a limited resource. Dynamic Message Signs (DMS) are often used but have no feedback capability.

RESEARCH OBJECTIVES

This research proposes to explore providing the driver with different feedback information--namely the amount of the dollar fine that would be imposed if the driver were cited for a speeding violation at the speed and location that the radar sensor measures. Comparisons would be made among (a) using speed feedback only, (b) using dollar traffic fine only, and (c) using both speed and traffic fine feedback.

EXPECTED IMPLEMENTATION

This project is expected to benefit both the public and ADOT regarding safety in zones for both workers and drivers; it is expected to provide ADOT with a potential method to improve speed reduction compliance in maintenance and construction zones. Benefits will potentially be realized with reduced speeds in work zones, which could reduce collisions. If the research is successful, then speed reduction in work (school) zones could save injury, property damage, and lives of workers and drivers. After proof of concept, a prototype(s) could be installed for more extensive field-testing, prior to statewide implementation.

STATUS OF THE RESEARCH

Project is kicked off, and PI has completed some groundwork. 9% complete.

Intelligent Transportation Systems (ITS)

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Scott E. Nodes	ADOT Transportation Technology Group / TOC Manager (Sponsor)
John Harper	ADOT Flagstaff District Regional Engineer (Champion)
Paul Porell	City of Scottsdale
Kohinoor Kar	ADOT Traffic Engineering
Madhu Reddy	ADOT Phoenix District Construction
Mike Lockhart	Arizona Department of Public Safety (DPS)
Kelly LaRosa	FHWA

SPR-682, ***Analysis of Freeway Bottlenecks: Capacity Reduction and Temporal Variations***

Research Agency:	Arizona State University	FY Authorization:	2009
Principal Investigator(s):	Soyoung Ahn	Contract Date:	8/3/2009
Contract Amount:	$80,000	Original Completion Date:	8/2/2010
Program Budget:	$80,000	Estimated Completion Date:	2/28/2011
Expenditures to date:	$19,997	Is project on schedule?	No
Available Amount:	$60,003	ADVANTAGE No.	R0682 19P
Percent complete	12%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

Traffic congestion is a major externality in modern transportation systems and has a negative economic, environmental and social impact. The 2007 Urban Mobility Report (Schrank and Lomax, 2007) states that the cost of congestion, in terms of delay and wasted fuel, is estimated to be about $78 billion in urban areas in the United States. This cost has steadily increased since 1982, and the trend will likely continue.

In the Phoenix metropolitan region, there are several recurrent bottlenecks, some of which result in long queues and large delays during rush hours. These bottlenecks have already been identified as part of the 2002 Maricopa Association of Governments (MAG) Freeway Bottleneck Study, which has provided general assessment and recommendations of countermeasures. However, developing effective countermeasures to improve freeway operations would benefit from more detailed analysis of various bottleneck features. Thus, this research will focus on several key bottlenecks and perform in-depth analysis to study the mechanism of bottleneck activation and temporal variation.

RESEARCH OBJECTIVES

The primary objective of this research is to provide a better understanding of detailed features of major recurring bottlenecks in the Phoenix metropolitan region and their temporal variations. The following list details the objectives that this study will attempt to achieve:

(1) Identify recurring bottlenecks that typically result in severe congestion
(2) Study the activation mechanism of the identified bottlenecks
(3) Evaluate the bottleneck capacity upon activation
(4) Evaluate the temporal variations in capacity
(5) Identify the factors that are significant to the variations.

This research is expected to enhance our understanding on behavior of bottlenecks in the Phoenix metropolitan area, to reduce variations in travel time perceived by users and to provide faster and more reliable services.

EXPECTED IMPLEMENTATION

It is anticipated that findings from this research will offer important knowledge to practitioners to develop guidelines for strategic planning for effective congestion management. In specific, this study would allow one to evaluate the congestion management systems that are currently deployed and identify the needs for new system implementations or any possible improvements of existing systems. Findings from this study will thus help develop a range of short-term solutions as well as longer-term initiatives that are practical and cost-effective. The solutions may include expansion of roadway, investments for intelligent transportation systems infrastructure for technology-based solutions, or ultimately, demand management.

STATUS OF THE RESEARCH

Section of draft final report about literature review is at ATRC but needs heavy editing and corroboration of mathematical statistical discussions. PI is finding test sites. 12% complete.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Scott E. Nodes	ADOT Transportation Technology Group / TOC Manager (Sponsor/Champion)
Glenn S. Jonas	ADOT Transportation Technology Group – TOC
Timothy M. Wolfe	ADOT Phoenix Maintenance District
Madhu Reddy	ADOT Assistant Phoenix Construction District Engineer
Mark Catchpole	ADOT Transportation Planning Division, Data Section
Sarath Joshua	Maricopa Association of Governments (MAG)
Jennifer Brown	FHWA

Maintenance – PROJECTS

SPR-500, *Aggregate Sources for Construction and Maintenance in Northern Arizona*

Research Agency:	Swan Consulting	FY Authorization:	2005
Principal Investigator(s):	Jeff Swan	Contract Date:	5/14/2010
Contract Amount:	$95,000	Original Completion Date:	01/01/2009
Program Budget:	$250,000	Estimated Completion Date:	12/31/2010
Expenditures to date:	$140,882	Is project on schedule?	No
Available Amount	$94,372	ADVANTAGE No.	R050012P
Percent complete	50%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

For the greater part of the interstate construction program, the Arizona Department of Transportation (ADOT) maintained the responsibility to locate acceptable aggregate sources for construction purposes. ADOT would locate sources of material, obtain all clearances and permits and perform the geotechnical analysis of the pit composition. At one time, ADOT maintained a database of over 8,000 material pits located around the state. This process made ADOT liable for material acceptability and often times resulted in claims from the contracting industry based upon misrepresentation of the character or quantity of material involved.

In more recent times ADOT turned over the material source issue to the contracting sector. The contractor currently is responsible for locating and obtaining pits for each individual construction project. This makes the contractor entirely responsible for his quality and quantity of material obtained.

Recently, material sources are becoming increasingly more difficult to find and use, even for the private sector. Many of the material sources in northern Arizona are located within reservations and the Indian nations have been less willing to allow access and use.

The lack of material availability is even affecting aggregate sources for maintenance use. There is a need to provide reliable aggregate sources for construction and maintenance activities.

RESEARCH OBJECTIVES

The objective of this research is to identify the aggregate sources available for construction and maintenance in northern Arizona and to determine the means by which these sources will be used.

The following minimum tasks will be performed:

1. Conduct a literature search relevant to available aggregate sources in Arizona.
2. Canvass the construction industry and other governmental agencies to establish additional pit sources and potential options for providing aggregate sources such as regionally located designated sources and or designated locations where materials are transported to or where

large aggregate crushing contracts are established to provide material sources for many projects.

3. Canvass ADOT construction and maintenance personnel for problem identification and potential solutions.
4. Determine the locations/potential locations of all available material sources in northern Arizona for use by the highway community.
5. Prepare a working paper summarizing the recommendations for providing aggregate sources for construction and maintenance purposes in northern Arizona for the next ten years. The working paper will provide all the justification and supplemental information necessary to support the recommendations.
6. Upon approval of the recommendations submitted in Task 5, develop an implementation plan that will provide the material sources necessary for construction and maintenance operations in northern Arizona for the next ten years. The plan will specify each location, the plan for developing the site(s) and any process changes necessary to use the sources.
7. Prepare a final report documenting the efforts of the study and the conclusions and recommendations.
8. Prepare a Research Note in accordance with Arizona Transportation Research Center (ATRC) procedures.
9. Conduct an executive presentation to the Research Council.

EXPECTED IMPLEMENTATION

The results from this research project will establish the aggregate sources for construction and maintenance activities in Northern Arizona.

STATUS OF THE RESEARCH

The first four tasks have been completed. Original PI could not complete remaining work so contract was cancelled and a new contract awarded to one of the subconsultant firms.

TECHNICAL ADVISORY COMMITTEE (TAC)

John Lawson	ADOT Materials Group (Champion/Sponsor)
Jim Delton	ADOT Materials Group
Randy Vuletich	ADOT Materials Group
Allan Samuels	ADOT Construction Section
Lynn Johnson	ADOT Holbrook District
Randy Pair	ADOT Holbrook District
Chad Auker	ADOT Flagstaff District
Mike Rice	Arizona State Land Department
Tom Deitering	FHWA
Stan Robbins	Apache County

SPR-617, *Evaluate Effects of Snowplow and Deicing Chemicals on Rubberized Asphalt Pavements*

Research Agency:	Nichols Consulting Engineers, Chtd.	FY Authorization:	2006
Principal Investigator(s):	Kevin Senn	Contract Date:	3/16/07
Contract Amount:	$116,740	Original Completion Date:	12/31/2008
Program Budget:	$116,740	Estimated Completion Date:	06/30/2010
Expenditures to date:	$47,292	Is project on schedule?	Yes
Available Amount:	$69,448	ADVANTAGE No.	R061718P
Percent complete	40%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

The application of de-icing chemicals to roads is a required winter maintenance method in order to maintain traffic safety. However, de-icing chemicals may have potential adverse impact on pavement surface. Most pavement surface damage results from a natural process called the freeze-thaw cycle. The freeze-thaw cycle involves moisture seeping into the cracks and surface pores and freezing. As the moisture changes to ice, it expands which puts stress on surfaces. De-icing chemicals increase the number of freeze-thaw cycles and can also double the rate of expansion during freezing. Weak pavements may crack or pit under this added stress. There is also a question as to whether the chemicals (chlorides and ant-corrosive agents) have an effect on the asphalt and rubber in the rubberized friction course. The chemicals may speed up the natural oxidation process and shorten the pavement life. To avoid pavement damage, using a pure traction aid such as garnet sand, rather than ice melting chemicals may be an option. However, if the maintenance of a clear highway is critical, the risk of surface damage against the potential liability must be considered. In Arizona, almost all the interstate highway pavement and most of the other pavement is surfaced with a rubberized friction course. The impact of the application of de-icing chemicals on rubberized pavements is not fully understood.

RESEARCH OBJECTIVES

The objectives include: (1) using field and laboratory experiments, evaluate the effect of the application of various ice and snow melting chemicals on rubberized pavements; and (2) select the most cost-effective ice and snow melting chemical blends, and application rate and procedure, and other accompanying pavement maintenance strategies for rubberized pavements to meet the goals of both traffic safety and reducing pavement damages related to the application of de-icing.

EXPECTED IMPLEMENTATION

District maintenance groups will implement the suggestions regarding applying de-icing chemicals. Materials group can implement the new findings regarding asphalt mix.

Maintenance

STATUS OF THE RESEARCH

The project is underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Julie Kliewer	ADOT Phoenix District (Champion)
Roy Alvis	ADOT Prescott District
Chad Auker	ADOT Flagstaff District
Tom Deitering	FHWA

SPR-628, *Evaluation of Maintenance Strategies for ADOT*

Research Agency:	Applied Pavement Technology, Inc.	FY Authorization:	2007
Principal Investigator(s):	David Peshkin	Contract Date:	8/01/07
Contract Amount:	$100,000	Original Completion Date:	01/01/2009
Program Budget:	$100,000	Estimated Completion Date:	06/30/2010
Expenditures to date:	$70,692	Is project on schedule?	Yes
Available Amount:	$44,307	ADVANTAGE No.	R062819P
Percent complete	50%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

ATRC research project SPR-371, *Maintenance Cost Effectiveness Study*, studied several hundred test sections throughout Arizona in three project phases. The study phases are wearing courses (Phase I), surface treatments (Phase II), and sealer-rejuvenators (Phase III). While the project came to an end by 2005, the maintenance strategies applied still have their anticipated remaining life ranging from 4 to 9 years. As a result, some of the goals of the SPR-371 project could not be met. Through further monitoring of those test sections, overall performance of the maintenance strategies related to environment, location, cost, availability etc. can be identified.

RESEARCH OBJECTIVES

1. Review ADOT's current maintenance strategies.
2. Document the materials (binder, admixture, aggregates etc.), gradation and volumetrics etc., used in each of the test treatment of the maintenance research project SPR-371.
3. Fully monitor the test sections constructed under maintenance research project SPR-371.
4. Evaluate performance of the maintenance strategies done in those sections.
5. Identify the effectiveness of maintenance treatments based on a matrix of cost, type of distress, location, constructability, service life etc.
6. Develop a specific provisional guideline of effective maintenance strategies for ADOT to follow.

EXPECTED IMPLEMENTATION

ADOT maintenance groups will use the resulting information to improve their practices.

STATUS OF THE RESEARCH

The project is underway.

Maintenance

TECHNICAL ADVISORY COMMITTEE (TAC)

Lonnie Hendrix	ADOT Central Maintenance (Champion)
Jim Delton	ADOT Materials Group (Sponsor)
Bill Hurguy	ADOT Materials Group
Javed Bari	ADOT Materials Group
Paul Burch	ADOT Materials Group
Sharon Gordon	FHWA

SPR-649*, Safety Issues Due to Unforeseen Stoppage of High Speed Mainline Traffic*

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$60,000	Estimated Completion Date:	N/A
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$60,000	ADVANTAGE No.	R064920P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

As the traffic characteristics change on our interstates, freeways and principal arterials, there are potential safety issues associated with increased traffic volume, congestion, sudden bottleneck, speed differential, non-use or misuse of HOV lane, under-use of alternative routes, etc. The situation becomes worse with highway work zones and unpredictable incidents. The problem is to perform a comprehensive literature review on the best practices to handle these types of situation, analyze a few candidate locations on Arizona highways and develop countermeasures. A possible engineering solution to this problem could be an application of the Intelligent Transportation System (ITS), e.g. using sensors detecting slow-moving or stopped vehicles, Variable Message Signs (VMS) with real-time coordination to provide dynamic and effective motorists' information. The proposed project will look into all effective and feasible solutions addressing the issues.

RESEARCH OBJECTIVES

This proposal encompasses a study to address the safety issues due to unforeseen stoppage of mainline traffic on our highways. The following deliverables are proposed:

- Summary of best practices
- Analysis of candidate locations
- Recommendation plans
- Rough cost estimates

The outcome of this research project will provide a direction to resolve the issues discussed above. Implementation of the recommendation plans will obviously be contingent upon the budget and ADOT approval.

EXPECTED IMPLEMENTATION

The results can be implemented in coordination with the existing ITS applications on ADOT highway systems. Traffic Operations, ITS Group or HES Section will be responsible for this implementation. If this research is quite comprehensive, a minimal follow-up research may be required. Cost of implementation cannot be estimated until the project is completed.

Maintenance

STATUS OF THE RESEARCH

The project is not yet underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Mike Manthey	Traffic Engineering (Champion/Sponsor)
TBD	Highway Enhancements for Safety
TBD	ADOT Traffic Engineering
TBD	ADOT Traffic Operations
Ted Howard	ADOT Risk Management
Jeff King	Arizona Dept. of Public Safety
Karen King	FHWA

SPR-690, *Automatic Vehicle Location (AVL) for Maintenance Work Effort Tracking: Phase 2 Integration*

Research Agency:	Pending	FY Authorization:	2010
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$85,000	Estimated Completion Date:	N/A
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$85,000	ADVANTAGE No.	R0690 22P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

As outlined in the Winter Storm Management Operations Manual, snow fighting activity documentation is recorded using hand written TAPER Logs, and these logs are filled out or attempted to be filled out at the time the driver is operating the snow plow. TAPER stands for: T-temperature of the pavement and air; A-application rate (pounds or gallons per lane per mile); P-product being applied; E-event type (heavy snow, sleet, dry snow, etc.); and R-results of the anti-icing and de-icing efforts. Several data entries in the TAPER logs are manually collected every time a plow operator tackles the snow fighting tasks under high-stress, hazardous conditions. Currently, the manual record-keeping takes the operator off required tasks and his/her safety as well as the safety of other motorists. The data being manually recorded by snow plow operators is important to capture due to environmental concerns of use of anti and deicing agents and their effects on vegetation, water quality, air quality, soils, etc. while at the same time improving the safety of the roadway and avoiding/mitigating tort claims. The ability to capture accurate and precise data through the use of technology is documented in ADOT's current research project, SPR-645 Automatic Vehicle Location for Maintenance Work Effort Tracking: Phase 1 Proof of Concept.

RESEARCH OBJECTIVES

The goal is to provide detailed reports of ADOT's snow fighting activities in the most effective and efficient manner. The objective is to integrate existing technologies for on-board systems (controller head) and collected and disseminated using telecommunications (T1 and/or WiFi), which can transfer data directly into ADOT's existing Performance Controlled System (PeCoS) to alleviate human error.

EXPECTED IMPLEMENTATION

Initial technology deployment in each maintenance org within the Globe District will leverage existing fleet equipped with on-board systems. Integration of the data collected into the current PeCoS system will be monitored and recorded as part of the research in anticipation of deleting hand written daily work reports and TAPER logs. Update statewide snow management guidelines to reflect new processes. Consistent work processes and procedures designed and

implemented to work in conjunction with the technology. Improved safety for operators since they will be able to focus on work tasks and not capturing data while operating snow fighting equipment.

STATUS OF THE RESEARCH

The project is not yet underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Lonnie Hendrix	ADOT Assistant State Maintenance Engineer (Sponsor)
John Wakefield	ADOT Central Fleet Equipment Services (Champion)
Kelly LaRosa	FHWA

Other TAC members to be determined

SPR-691, *Development of Application Rate Guidelines for Winter Storm Management Chemical Additives in Use by ADOT through an Ambient Monitoring System*

Research Agency:	Pending	FY Authorization:	2010
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$200,000	Estimated Completion Date:	N/A
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$200,000	ADVANTAGE No.	R069122P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

The application of anti-icing and deicing chemicals by ADOT has become one of their most effective winter storm management measures. It is widely known that chemical additives related to winter storm management activities can impact water quality and soil salinity. The primary factors in determining environmental impacts resulting from the use of chemical additives are the type and amount of chemicals used. An increase in the amount of chemical additive applied to a transportation corridor equates to an increased potential for additives in pavement runoff and snowmelt. Yet, the total amount of chemicals used will depend largely on the number and severity of winter storms being managed. Unfortunately, the over-application of the chemical additives can often result in environmental impacts.

RESEARCH OBJECTIVES

The desired outcome of this research is to recommend initial application rate guidelines, implement a winter storm management recordkeeping system of chemical usage and storm events along transportation corridors, and define how best to evaluate that information to minimize potential environmental impacts. The focus of the research will be to identify trends indicating the accumulation of chemicals along transportation corridors and observed or potential impacts to natural resources associated with these accumulations.

EXPECTED IMPLEMENTATION

Districts would be issued application rate guidelines for winter storm management chemical additives specific to their critical roadway segments, in both the form of a memorandum and a users' chart that specifies the application rate of the target chemical as a function of roadway and weather conditions.

STATUS OF THE RESEARCH

The project is not yet underway.

Maintenance

TECHNICAL ADVISORY COMMITTEE (TAC)

Todd Williams	ADOT Office of Environmental Services (Champion)
Lonnie Hendrix	ADOT Maintenance (Sponsor)
TBD	FHWA

Other TAC members to be determined.

SPR-694, *Evaluation of Rural Traffic Operations Center Capabilities and Needs*

Research Agency:	Pending	FY Authorization:	2010
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$120,000	Estimated Completion Date:	N/A
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$120,000	ADVANTAGE No.	R069422P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

The Arizona Department of Transportation (ADOT) Traffic Operations Center (TOC) monitors traffic information statewide. TOC provides support to regions outside the Phoenix metropolitan area both during and after normal weekday working hours. Each of the three northern ADOT districts operate their own TOC during normal weekday working hours. Further, Department of Public Safety (DPS) districts play an important role in emergency traffic management functions. Outside the Phoenix area the DPS districts are not systematically coordinated with ADOT districts. There is a perceived need for a more standardized, efficient approach among ADOT District Engineers and among DPS managers in the areas outside Phoenix.

RESEARCH OBJECTIVES

Phase 1:

1.Assess ADOT's incident and highway operations management in detail on a statewide basis by meeting with core stakeholders in all districts.

2.Review the practices of other state departments of transportation (DOTs), and prepare central and regional TOC options for stakeholder consideration. Provide recommendations as to whether the current ADOT approach should be retained or modified.

Phase 2:

If the Phase 1 study recommends alternatives to the current system, a Phase 2 study will develop specific program elements necessary to develop the alternative systems. The program elements will include system concepts, equipment needs and costs. The Phase 2 study will also update, refine and optimize the operational procedures and lines of responsibility and communication for both incidents and day-to-day activity statewide.

Maintenance

EXPECTED IMPLEMENTATION

If an alternative TOC system is pursued based on the study, the study results will be used to propose a capital improvement plan to build and operate the alternative system. The plan would aim at securing funding for design and construction of the system.

STATUS OF THE RESEARCH

The project is not yet underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Bill Tait	ADOT Maintenance Group (Champion)
Dallas Hammit	ADOT State Engineer's Office (Sponsor)
TBD	Other Organizations
TBD	FHWA

Materials and Construction – PROJECTS

SPR-396, *LTPP and Other Test Section Management and Evaluation*

Research Agency:	Arizona Transportation Research Center	FY Authorization:	1995
Principal Investigator(s):	Nichols Consulting	Contract Date:	10/28/2005
Contract Amount:	$96,000*	Original Completion Date:	06/30/2011
Program Budget:	$246,000	Estimated Completion Date:	06/30/2011
Expenditures to date:	$77,200	Is project on schedule?	Yes
Available Amount	$168,800	ADVANTAGE No.	R039618P
Percent complete	75%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

* $140,000 for a second phase is pending

PROBLEM STATEMENT

Since 1989, in support of the Strategic Highway Research Program, ADOT has constructed more Special Pavement Study (SPS) Test Sections than any other highway agency in the United States. In 2006, most SPS test sections were covered up with new construction/ pavement preservation. Although this completed the end of the 15-20 year life cycle, all data collection was completed prior to construction or rehabilitation. This study completes the analysis portion of the collected data and finalizes it into a research quality report. A draft final report analyzing the data for SPS-6 is currently being reviewed.

RESEARCH OBJECTIVES

The objective is to complete a forensic analysis on all LTPP data to include profile analysis, falling weight deflectometer, and distress analysis. The forensic analysis will document the performance range of various pavements.

EXPECTED IMPLEMENTATION

LTPP data will be combined with ADOT's Pavement Management Services (PMS) data and then compared to pavement prediction models to better correlate pavement design. The performance results will help calibrate the new National Mechanistic Empirical pavement design method to local Arizona conditions.

STATUS OF THE RESEARCH

In June 2007, the Research Council approved the final $150,000 to conduct full data testing and analysis of the now out-of-study sections. Evaluation reports on the SPS profiles are underway by Nichols Consulting, Inc. Final reports for all SPS profiles are due within the next 36 months.

TECHNICAL ADVISORY COMMITTEE (TAC)

Dallas Hammit	ADOT State Engineer's Office
Jim Delton	ADOT Materials Group
Julie Kliewer	ADOT Phoenix Construction District
Paul Burch	ADOT Materials Group
Murari M. Pradhan	ADOT Regional Materials Engineer
David Burbank	ADOT Regional Materials Engineer
Chad Auker	ADOT Regional Materials Engineer
Tom Deitering	FHWA

SPR-577, *Pavement Noise Study*

Research Agency:	Illingworth and Rodkin	FY Authorization:	2004
Principal Investigator(s):	Paul Donovan	Contract Date:	10/28/2009
Contract Amount:	$293,000	Original Completion Date:	10/30/2010
Program Budget:	$293,000 ($657,000 total *)	Estimated Completion Date: (first 5 years)	10/30/2010
Expenditures to date:	$239,935	Is project on schedule?	Yes
Available Amount	$53,065	Advantage No.	R057717P
Percent complete	50%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

*See Table in Status of Research Heading

PROBLEM STATEMENT

Historically, noise mitigation measures used in the U.S. transportation industry have included use of barriers, walls, and separation (e.g., distance). These methods have been the only acceptable solutions for federally funded projects. Quiet pavements can also be used to mitigate noise but are not currently permitted because the Federal Highway Administration (FHWA) does not view them as a permanent solution.

In Arizona, like other states, berms and walls are the primary noise mitigation measures in the urban corridors. In April 2003, ADOT received approval from FHWA to allow the use of pavement surface type as a noise mitigation strategy. This approval allowed the use of Asphalt Rubber Friction Course (ARFC) overlays as a noise mitigation strategy when used on existing and newly constructed concrete pavements. Where this surfacing is used, ADOT receives a four-decibel reduction for the design of walls and berms. This credit equates to a six to eight foot reduction in wall or barrier height. Perhaps a more meaningful analogy is that if just a three-decibel reduction were achieved through the use of a quiet pavement, it would have a noise impact of about half of the actual traffic volume.

The FHWA approval was granted with the condition that Arizona be a pilot program, with specific research objectives and requirements. The required research is intended to validate the efficacy of using ARFC as a noise mitigation strategy. Since the FHWA was concerned that a pavement solution is not a permanent solution, they requested a pilot program to study the long-term performance of the ARFC overlay. ADOT committed to a long-range study for up to 10 years, the estimated minimum life cycle of the ARFC pavement.

ADOT is currently conducting research which focuses on Type 1 (source noise), Type 2 (residential neighborhood), and Type 3 (wayside noise measurement) sites.

RESEARCH OBJECTIVES

The objective of the research is to measure and compare noise generated from different pavement types over time. The effects of pavement design and pavement age will be monitored as they affect noise generation from vehicle traffic.

EXPECTED IMPLEMENTATION

The results of the research will be used in the design of future road construction projects.

STATUS OF THE RESEARCH

A JPA with the Federal Highway Administration Volpe Center is complete. The Volpe center will monitor 2 of the 5 test sites. ADOT will monitor the other 3. An interim report will be published within 6 months. The table below shows funding in the corresponding fiscal years:

SPR Fund Source	FY 2004	FY 2005	FY 2008	FY 2010	Totals
Part I (Planning)	$364,000	-	-	-	$364,000
Part II (Research)	-	$99,000	$97,000	$97,000	$293,000
			Program Total		**$ 657,000**

Spinoff studies were funded in FY 2007 and FY2009 for $97,124 and $39,488 respectively. A second 5 year phase is pending with an annual budget of $140,000.

TECHNICAL ADVISORY COMMITTEE (TAC)

Floyd Roehrich	ADOT State Engineer's Office
Barney Remington	ADOT Environmental Planning Group
Fred Garcia	ADOT Environmental Planning Group
Thor Anderson	ADOT Environmental Planning Group
Ali Zareh	ADOT Pavement Design
Mary Frye	FHWA
Bill Vachon	FHWA
Thomas Deitering	FHWA

SPR-605, *Investigations of Environmental Effects on Freeway Acoustics*

Research Agency:	Arizona State University	FY Authorization:	2006
Principal Investigator(s):	Dr. Joe Fernando	Contract Date:	05/04/2006
Contract Amount:	$155,000	Sched. Completion Date:	12/04/2010
Program Budget:	$155,000	Est. Completion Date:	12/04/2010
Expenditures to date:	$144,295	Is project on schedule?	Yes
Available Amount	$10,705	ADVANTAGE No.	R060518P
Percent complete	90%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

In April of 2003, ADOT received approval from the FHWA to allow the use of pavement surface type as a noise mitigation strategy. This was granted with the condition that Arizona would conduct a pilot program related to this strategy. A research program was developed to validate the efficacy of using Asphalt Rubber Friction Courses (ARFC) as a noise mitigation strategy. ADOT has begun to monitor four sites across the Phoenix Metropolitan area over a ten-year period to evaluate the effectiveness of ARFC. Recent experiences, however, suggest that traditional noise abatement approaches (e.g. the use of walls) can be defeated by environmental conditions. In the last year, researchers at Arizona State University helped ADOT to monitor environmental conditions associated with acoustic monitoring. In the first (completed) phase, the effects of winds on noise propagation were studied. However, the effects of inversions have not been studied, although they are known to be important; and this will be focus of the proposed work.

RESEARCH OBJECTIVES

In order to understand the influence of stability (inversion) conditions on sound propagation, we will conduct environmental monitoring, concurrent with ADOT acoustic monitoring, under different stability conditions -- during the night or early in the morning, before inversion breakup and during the afternoon during the unstable conditions. Detailed profiles of wind speed and temperature will be obtained using a SODAR (Sound Detection And Ranging) system and its RASS (Radio Acoustic Sounding System) extension. The SODAR remotely sense the wind speed and turbulence statistics profiles in the lower atmosphere (15-1000m). RASS provides the temperature and sound speed profiles (both instruments are available for the ASU group). If surface measurements are needed (< 15m), tethered balloons can be employed. The deliverables of the project are: (i) All temperature, velocity and humidity data in the required forms; (ii) Plots showing the effects of inversions on sound propagation – a manual of results; (iii) Analysis of results; (iv) Final report detailing the procedure, uncertainties, analysis, results and inferences.

EXPECTED IMPLEMENTATION

The results will be melded with ADOT sound monitoring data.

Materials and Construction

STATUS OF THE RESEARCH

The final report has been approved by the FHWA. A second phase is currently in progress.

TECHNICAL ADVISORY COMMITTEE (TAC)

Christ Dimitroplos	ATRC; M&C Project Manager; Champion
Larry Scofield	AZ Concrete Pavement Association (ACPA)
Tom Kombe	ATRC, Environmental Project Manager
Fred Garcia	ADOT Environmental Group
Hugh Saurenman	ATS Consulting

SPR-606, *Implementation of the Mechanistic-Empirical (M-E) Design Guide for Arizona*

Research Agency:	Applied Research Associates	FY Authorization:	2006
Principal Investigator(s):	Dr. Michael Darter	Contract Date:	04/22/2010
Contract Amount:	$255,000	Original Completion Date:	12/31/2010
Program Budget:	$255,000	Estimated Completion Date:	12/31/2010
Expenditures to date:	$0	Is project on schedule?	Yes
Available Amount	$255,000	ADVANTAGE No.	R060618P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

To complete the final phase of current Project SPR-402: Implementation of the Mechanistic-Empirical Design Guide for Arizona.

Task 1- Accurately calibrate the pavement performance models to local field conditions.

Task 2 - How to implement the Mechanistic-Empirical Design Guide for pavement design and performance prediction in Arizona.

Task 3- Develop a framework for performance related specifications for Arizona.

RESEARCH OBJECTIVES

To calibrate pavement performance models to local conditions using Arizona field data. The result will enable ADOT to utilize the M-E Design Guide and develop a framework for Pavement Performance related specifications.

EXPECTED IMPLEMENTATION

The overall assessment of the utility of the Mechanistic Empirical Design Guide calibrated for Arizona materials and conditions. Framework for pavement performance related specifications for Arizona.

STATUS OF THE RESEARCH

The project is in progress.

Materials and Construction

TECHNICAL ADVISORY COMMITTEE (TAC)

Jim Delton	ADOT Materials
Scott Weinland	ADOT Materials
Paul Burch	ADOT Materials
Bill Hurguy	ADOT Materials
Christ Dimitroplos	ADOT ATRC
Thomas Deitering	FHWA
Private Industry	Pending

SPR-631, *Evaluate Warm Mix Technology for Use in Asphalt Rubber – Asphaltic Concrete Friction Courses (AR-ACFC)*

Research Agency:	Pending	FY Authorization:	2007
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	$90,000	Original Completion Date:	Pending
Program Budget:	$90,000	Estimated Completion Date:	N/A
Expenditures to date:	$0	Is project on schedule?	N/A
Available Amount:	$90,000	ADVANTAGE No.	R063119P
Percent complete	20%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

European countries are using technologies that allow a reduction in the temperatures at which asphalt mixes are produced and placed. These technologies have been labeled Warm Mix Asphalt (WMA). The immediate benefit to producing WMA is the reduction in energy consumption required by burning fuels to heat traditional hot mix asphalt (HMA) to temperatures in excess of 300° F at the production plant. With the decreased production temperature comes the additional benefit of reduced emissions from burning fuels, fumes, and odors generated at the plant and the paving site. The technology allows the production of WMA by reducing the viscosity of the asphalt binder at a given temperature. This reduced viscosity allows the aggregate to be fully coated at a lower temperature than what is traditionally required in HMA production. There have been a number of demonstration projects in the US with a variety of mixes and binders, but none with asphalt rubber.

RESEARCH OBJECTIVES

Conduct a two-phase project to evaluate the applicability of warm mix asphalt technology to ADOT's AR-ACFC mixes.

The first phase would be principally a laboratory evaluation and review of relevant literature designed to answer the following questions:

Are the existing WMA technologies compatible with the asphalt rubber binders used in ADOT's AR-ACFC mixes?

How does ADOT's design procedure for AR-ACFC mixtures need to be modified to accommodate WMA technologies?

The second phase would be primarily a field trial with the following research objectives:

- Characterize (quantify) the potential plant production / mix lay-down savings that can be generated by using WMA technologies in AR-ACFC (e.g. energy cost reduction, reduced emissions, etc.)
- Characterize the impact of incorporation WMA technologies into AR-ACFC mixes on the surface characteristics of the mix (e.g. noise reduction capabilities, frictional characteristics, and smoothness)
- Evaluate the potential for extension of the paving window for AR-ACFC resulting from reduced paving temperatures (e.g. minimum surface temperature, paving season)

EXPECTED IMPLEMENTATION

This research has the significant potential to reduce the plant production and placement costs due to decreases in energy costs. Materials Group will implement the findings in the form of revised specifications and test methods on future projects. Materials Group will implement any recommended changes to the AR-ACFC paving window (temperature and season).

STATUS OF THE RESEARCH

The Project status is pending.

TECHNICAL ADVISORY COMMITTEE (TAC)

Sharon Gordon	FHWA
Thomas Deitering	FHWA
John Shi	Maricopa County DOT
Scot Weinland	ADOT
Paul Burch	ADOT
Javed Bari	ADOT
Bob McGennis	Holly Asphalt
Joe Phillips	AMEC
Don Green	Cemex

SPR-633*, Economical Concrete Mix Designs Utilizing Blended Cements, Performance Based Specifications, and Rational Pay Factors*

Research Agency:	ASU	FY Authorization:	2007
Principal Investigator(s):	Dr. Barzin Mobasher	Contract Date:	01/05/2010
Contract Amount:	$90,000	Original Completion Date:	07/31/11
Program Budget:	$90,000	Estimated Completion Date:	07/31/11
Expenditures to date:	$42,400	Is project on schedule?	Yes
Available Amount:	$77,600	ADVANTAGE No.	R063319P
Percent complete	10%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

There is a need to contain the escalating costs of construction projects through the use of economical concrete materials and rational acceptance criteria. This is a proposal to increase competitiveness among project bidders by improving the procedures for materials selection, specifications, and also pay factors for contract administration. A preliminary study conducted for joint ADOT/ARPA committee has indicated that there are significant potential cost savings through the reduction of minimum specified cement content in various grades of concrete. Such reductions however must be accomplished so that the performance of final product is not jeopardized. This project will utilize and evaluate recent advances in performance enhancing mineral admixtures and supplementary cementitious materials, in addition to QC parameters used for specification and acceptance criteria in order to develop economical concrete mixtures.

RESEARCH OBJECTIVES

Promote better quality and economics of using concrete materials by focusing on:

1. Mix design formulation based on economy, superior performance, quality control, and durability.

2. Better utilization of mineral admixtures such as flyash through reducing the minimum cement requirements for 2500 psi and 3000 psi concrete mixtures.

3. Evaluation of the acceptance criteria and pay factor adjustment methods based on a bonus/penalty factors in improving quality control and specification procedures.

EXPECTED IMPLEMENTATION

Results can improve the quality of concrete construction in the State of Arizona while saving millions of dollars in construction costs. Historical ADOT data will be evaluated and calibrated against the proposed models that will be developed in this program. Special provisions will be developed and presented to the ADOT materials group. Specifications for new classes of concrete and their associated pay factors will be chosen. Testing and evaluation protocol for field trials as a follow up to this study will be identified.

STATUS OF THE RESEARCH

An interim report is being reviewed.

TECHNICAL ADVISORY COMMITTEE (TAC)

Paul Sullivan	ADOT Materials Group
Daniel Seagerman	ADOT Materials Group
Thomas Deitering	FHWA

SPR-644, *Continuum Damage Theory applied for Asphalt Rubber Mixtures*

Research Agency:	Arizona State University	FY Authorization:	2007
Principal Investigator(s):	Dr. Kamil Kaloush	Contract Date:	12/07/07
Contract Amount:	$25,000	Original Completion Date:	11/30/2009
Program Budget:	$25,000	Estimated Completion Date:	11/30/2009
Expenditures to date:	$20,000	Is project on schedule?	Yes
Available Amount:	$5,000	ADVANTAGE No.	R064419P
Percent complete	80%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

Recently, Continuum Damage Theory has been successfully applied in uniaxial fatigue tests for asphalt mixtures (Lee et. al ASCE, 2000). The relationship C-D (pseudo stiffness – Damage parameter) has been proven unique to each mixture, regardless of temperature, strain level, frequency, and type of loading (monotonic and cyclic). The results showed that developing this relationship C-D, reduced the number of fatigue tests necessary to evaluate asphalt mixtures. Furthermore, with simple formulation, fatigue life may be predicted knowing both the viscoelastic properties and the damage parameter. Using the same approach, fatigue tests with rest periods may be used to characterize mixtures with regards to the healing process. Continuum Damage Theory will likely be included in future revised pavement design numerical code, such as the Mechanistic Empirical Pavement Design Guide (MEPDG). Since no work in this area included asphalt rubber mixtures, a realistic model to characterize such fatigue behavior is needed.

Both ADOT and ASU have been focusing on characterizing asphalt rubber mixtures based on their unique behavior. A continuum damage approach assessment will potentially reduce the time consuming process of conducting many flexural beam fatigue tests in the laboratory.

RESEARCH OBJECTIVES

The main objective of this study is to evaluate the possibility of applying and comparing results of the above Continuum Damage Theory to Asphalt Rubber Mixtures using two types of tests available at ASU: Beam and Uniaxial Fatigue Tests.

The tasks required are:

1. Brief documentation of the continuum damage theory;
2. Conduct analysis using this new approach on beam fatigue tests data already available in the ASU database from previous ADOT mixtures testing;
3. Conduct beam fatigue tests on ADOT asphalt mixtures, using the traditional (currently being done) and the new approach;
4. Perform uniaxial fatigue tests on ADOT conventional and asphalt rubber mixtures (new testing in this study)

5. Analyze the results, provide a comparative analysis and submit a fully explanatory and well-documented final report that incorporates the findings of tasks 1 through 4.

EXPECTED IMPLEMENTATION

It is expected that the study will result in a possibility to implement those mixtures characteristics in the new MEPDG in the future.

STATUS OF THE RESEARCH

The project report is being reviewed.

TECHNICAL ADVISORY COMMITTEE (TAC)

Jim Delton	ADOT State Materials Engineer (Sponsor)
Ali Zareh	ADOT Pavement Design (Champion)
Javed Bari	ADOT Pavement Design
Dan Anderson	ADOT Materials Testing

SPR-656, *Asphalt Rubber Mixtures Susceptibility to Moisture Damage*

Research Agency:	Arizona State University	FY Authorization:	2008
Principal Investigator(s):	Dr. Kamil Kaloush	Contract Date:	12/07/07
Contract Amount:	$25,000	Original Completion Date:	08/31/2009
Program Budget:	$25,000	Estimated Completion Date:	08/31/2009
Expenditures to date:	$19,870	Is project on schedule?	Yes
Available Amount:	$5,130	ADVANTAGE No.	R065620P
Percent complete	80%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

Between 1989 and 2004, a total of 135 projects were constructed using the asphalt rubber gap graded asphalt rubber-asphalt concrete (ARAC) mix totaling 3521 lane miles. The performance of these mixes has been excellent. However, in 2004, four projects suffered from premature failure and developed rutting, shoving and washboard within one year of construction. Field observation and forensic evaluations indicated that stripping / moisture damage may have been the cause of this premature failure. Currently, there are no standards or laboratory test data in Arizona to support the knowledge area on the susceptibility of asphalt rubber mixtures to moisture damage. There is a need to develop acceptance limits / criteria for asphalt rubber mixtures to guard against possible moisture damage in the field.

RESEARCH OBJECTIVES

The objective of this study is to identify if any of the recent laboratory tests implemented in the pavement community (Simple Performance Tests) are able to assess the susceptibility of asphalt rubber mixtures to moisture damage. Of particular interest, whether the evaluation of the AASHTO T 283 Modified Lottman moisture susceptibility test can be successfully applied.

The tasks required are:

1. Brief literature documentation on moisture damage and test procedures;

2. Conduct laboratory testing program on asphalt rubber-asphalt concrete friction course (AR-ACFC), ARAC, and conventional HMA mixes using AASHTO T 283 to determine the indirect tensile strength and percent retained strength.

3. Conduct similar tests as in task 2 but using the E* dynamic modulus to determine the percent retained strength.

4. Using the Mechanistic-Empirical Pavement Design Guide (MEPDG) software, simulate the stripping problem in the field using reduced moduli (E*) and examine the impact on rutting development.

5. Analyze the results, provide a comparative analysis and submit a fully explanatory and well-documented final report that incorporates the findings of tasks 1 through 4.

EXPECTED IMPLEMENTATION

This research will provide the first step toward the development of a mix design acceptance criteria for asphalt rubber mixtures to protect against moisture damage.

STATUS OF THE RESEARCH

The final report is being reviewed.

TECHNICAL ADVISORY COMMITTEE (TAC)

Jim Delton	ADOT State Materials Engineer (Sponsor)
Ali Zareh	ADOT Pavement Design (Champion)
Javed Bari	ADOT Pavement Design
Dan Anderson	ADOT Materials Testing
Dan Simpson	ADOT Materials Testing

SPR-672*, Development of a Traffic Data Input System in Arizona for the Mechanistic Empirical Pavement Design Guide*

Research Agency:	Applied Research Associates	FY Authorization:	2009
Principal Investigator(s):	Dr. Michael Darter	Contract Date:	4/16/2009
Contract Amount:	$150,000	Original Completion Date:	10/16/2010
Program Budget:	$150,000	Estimated Completion Date:	10/16/2010
Expenditures to date:	$7,178	Is project on schedule?	Y
Available Amount:	$142,822	ADVANTAGE No.	R067221P
Percent complete	5%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

In the next five years, the Arizona Department of Transportation (ADOT) will spend 6.5 billion dollars in its highway construction program. A significant portion of that money will be used for the highway pavement structures. Traffic data is one of the key data elements required for the design/analysis of all pavement structures. Currently, the only traffic data available to the Pavement Design Section for designing Arizona pavements are: (i) Annual Average Daily Traffic (AADT) obtained from the Multimodal Planning Division, and (ii) Equivalent Single Axle Load (ESAL) data predicted by the Pavement Management Section. It is noteworthy that the prediction is based on the statewide traffic survey completed in 1997, which was started in 1995. Since the current predictions are based on a very old survey, it is very important that new regular data collection and periodic traffic surveys be conducted. As ADOT is getting ready to adopt the new Mechanistic Empirical Pavement Design Guide (MEPDG), the old survey data will become incompatible with the new design protocols. The MEPDG requires a major change in the way ADOT has been acquiring and compiling the traffic data. For example, the MEPDG uses traffic load spectra data instead of calculating ESALs. Therefore, it is imperative that ADOT has a comprehensive traffic data input system.

RESEARCH OBJECTIVES

1. Identify the needs of various sections within ADOT in terms of traffic data specifically related to the American Association of State, Highway and Transportation Officials (AASHTO) 1993 Pavement Design Guide and the new MEPDG.
2. Evaluate the current ADOT practice in terms of obtaining, compiling and managing traffic data.
3. Critically investigate into the existing traffic data collection infrastructures, such as weigh in motion (WIM) stations, and determine their validity and usefulness for use with the MEPDG.
4. Develop a detailed action plan for ADOT to continuously obtain all necessary traffic data and compile that information for effective use in the MEPDG. The action plan should also include a detailed cost estimate.

EXPECTED IMPLEMENTATION

Implementation will require changes in the work done by the Data Team in MPD and changes in the final product they provide to the Materials group. Implementation would be in stages as the MEPDG is incorporated into our Pavement Design and Management processes.

STATUS OF THE RESEARCH

The Project is in progress. An interim report is due summer 2010.

TECHNICAL ADVISORY COMMITTEE (TAC)

Jim Delton	ADOT Materials
Paul Burch	ADOT Materials
Javed Bari	ADOT Materials
Ron Fregin	ADOT Materials Group
Mark Hodges	ADOT Planning Division
Douglas Eberline	ADOT Planning Division
Mark Catchpole	ADOT Planning Division
Thomas Deitering	FHWA
Private Industry	Pending

SPR-673*, Performing Lifecycle Cost Analysis of HPC and Developing HPC Specifications for ADOT Bridge Projects*

Research Agency:	JEC Inc	FY Authorization:	2009
Principal Investigator(s):	Tarif Jaber	Contract Date:	4/28/09
Contract Amount:	$175,000	Original Completion Date:	05/31/2011
Program Budget:	$175,000	Estimated Completion Date:	05/312011
Expenditures to date:	$9,000	Is project on schedule?	Yes
Available Amount:	$166,000	ADVANTAGE No.	R067321P
Percent complete	5%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

Using High Performance Concrete (HPC) on bridge decks has been found to improve concrete quality, extend service life of the structure and reduce maintenance. Many state agencies have used HPC on bridges and have developed special specifications for implementing HPC. While there might be an increase in construction cost for using HPC on bridge projects, a lifecycle cost analysis is needed to evaluate and confirm the cost benefits of using HPC local materials and technology on Arizona bridge projects.

Successful implementation of HPC on bridges requires proper specification of materials and technology. The Arizona Department of Transportation (ADOT) currently does not have a specification to facilitate the successful implementation of HPC on bridges. ADOT uses HPC materials on bridge deck repair projects, but the current specification lacks the technology and the provisions to make sure HPC implementation is carried out properly and HPC benefits are achieved.

RESEARCH OBJECTIVES

1. Provide ADOT with lifecycle cost analysis needed to evaluate the benefits of using HPC on bridge projects in Arizona in hot and arid climates and under various exposure conditions found in Arizona.
2. Develop a stand-alone special provision prescriptive specification for HPC bridge decks. ADOT will use this specification to implement HPC on bridge projects in Arizona.
3. Provide an interim performance specification for use on future ADOT bridge projects. Data collected and experience gained from implementing HPC on upcoming bridge projects using prescriptive specifications will help ADOT update and finalize this interim performance specification.

EXPECTED IMPLEMENTATION

1. Meet with the Technical Advisory Committee (TAC) to discuss and confirm the scope of work and action plan.

2. Perform lifecycle cycle cost analysis to assess the economic feasibility and rate of return for using local construction and material to implement HPC on bridges in Arizona.

3. Develop a prescriptive specification for implementing HPC using ADOT specification formats.

4. Develop an interim performance specification for future implementation of HPC.

5. The results from tasks 2 and 3 will be presented to TAC for review and approval.

6. A final report will be presented that includes:
    a. A lifecycle cost analysis
    b. A special provision HPC specification.
    c. HPC guidelines, proposed test methods and acceptance limits.

STATUS OF THE RESEARCH

The Project is in progress.

TECHNICAL ADVISORY COMMITTEE (TAC)

Paul Sullivan	ADOT Materials
Gregg Inman	ADOT Materials
Shawn Farahzadi	ADOT Construction Group
Pe-Shen Yang	ADOT Bridge Group
Aryan Lirange	FHWA

SPR-674*, Engineering Properties of Recycled ARFC Overlays*

Research Agency:	Arizona State University	FY Authorization:	2009
Principal Investigator(s):	Dr. Kamil Kaloush	Contract Date:	Pending
Contract Amount:	$75,000	Original Completion Date:	12/31/2011
Program Budget:	$75,000	Estimated Completion Date	12/31/ 2011
Expenditures to date:	30,0000	Is project on schedule?	Yes
Available Amount:	$45,000	ADVANTAGE No.	R067421P
Percent complete	40%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

Many existing Asphalt Rubber Friction Course (ARFC) overlays are reaching the end of their life cycle, which will necessitate their replacement in the coming years. An option to reduce the costs associated with replacement would be to recycle the existing material and reuse it in future ARFC overlay projects. However, the performance characteristics of the recycled ARFC are unknown.

RESEARCH OBJECTIVES

The goal of this study will be to develop an experimental laboratory program to obtain typical engineering properties of the recycled ARFC mixes and compare them to conventional ARFC mixes. The tasks required for the successful completion of this study are:

1. Identify an Arizona Department of Transportation (ADOT) recycling ARFC project, and develop a detailed work plan.
2. Sample the mix during construction and bring back to Arizona State University laboratories. Laboratory specimens will be prepared and subjected to typical ADOT-ASU testing program. The tests will include: triaxial shear strength, dynamic modulus, static creep and repeated load for permanent deformation characterization; indirect tensile creep test for thermal cracking; and flexural beam tests for fatigue and fracture cracking evaluation.
3. Analyze results and compare them with conventional ARFC mixtures test data.
4. Conduct field performance evaluation.
5. Provide a summary report of the laboratory and field findings; present the findings at a technical advisory committee meeting.

EXPECTED IMPLEMENTATION

The results of this study could be used immediately for the future design of recycled ARFC mixes.

Materials and Construction

STATUS OF THE RESEARCH

The Project is in progress.

TECHNICAL ADVISORY COMMITTEE (TAC)

Jim Delton	ADOT State Materials Engineer (Sponsor)
Paul Burch	ADOT Pavement Design (Champion)
Ali Zareh	ADOT Pavement Design
Javed Bari	ADOT Pavement Design
Thomas Deitering	FHWA

SPR-692, *Development of a Comprehensive Plan to Enhance ADOT's Pavement Management Forecasting and Decision Making Capability*

Research Agency:	Pending	FY Authorization:	2010
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Original Completion Date:	Pending
Program Budget:	$400,000	Estimated Completion Date:	N/A
Expenditures to date:	$0	Is project on schedule?	N/A
Available Amount:	$400,000	ADVANTAGE No.	R06xx21P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

As the Department of Transportation approaches the second decade of this century, it is clear that the implementation of significant improvements in project development and system preservation are mandatory. Historically, improvements to transportation infrastructure have directly correlated with improvements to the Local, State and National economy. To maximize asset management; to facilitate pavement design and pavement preservation; and to precisely target highway infrastructure improvements, it is critical that the Department enhance its Pavement Management cross-functional interconnectivity.

The Pavement Management Section is lacking the ability to support the Materials Group's new Mechanistic-Empirical Pavement Design Guide. Designers are unable to access critical information concerning pavement condition, including the extent of traffic exposure, and the type and extent of cracking. In addition, there is no existing provision that facilitates updating and distribution of critical data to the Engineering Districts. This research is expected to recommend and provide some type of software that will provide real time access to pavement condition and design data on a state-wide basis, in a manner that can be readily used by Highway Development and Engineering District personnel. Implementation will result in lower costs to develop highway design strategies. Even more importantly, it will result in lower costs for the construction and maintenance of the State's highways throughout their lifecycle.

RESEARCH OBJECTIVES:

1. Review the Department's current Pavement Management System interdisciplinary data sharing functionality.
2. Identify the critical connectivity nodes and determine the relative strength or weakness of their ability to transfer the appropriate data.
3. Evaluate the performance of extant alternative systems to determine their potential to enhance the Pavement Management Section's link to ADOT's maintenance systems, the bridge systems, and the ***AASHTO Mechanistic-Empirical Pavement Design Guide*** requirements.
4. Implement a functional web based database that is compatible with these research objectives, and will monitor the Pavement Management organization's network optimization and interdisciplinary connectivity.

EXPECTED IMPLEMENTATION:

The project will significantly improve ADOT's pavement condition forecasting and decision making capability. It will facilitate database maintenance and data validation thereby maximizing both development and operations efficiency. Enhanced pavement preservation strategies and resource allocation will reduce transportation life cycle costs.

STATUS of the RESEARCH:

The Project has not begun. The project kick-off is pending a request for information (RFI).

TECHNICAL ADVISORY COMMITTEE

Jim Delton	ADOT Materials Group (Sponsor)
William Hurguy	ADOT Materials Group (Champion)
Yongqi Li	ADOT Materials Group
Mafiz Mian	ADOT Materials Group
Ron Fregin	ADOT Materials Group
Lonnie Hendrix	ADOT Maintenance
Joel Miller	ADOT Globe District
TAC Member	FHWA

Planning and Administration – PROJECTS

SPR-613, *Quantifying the Impact of Opening a New Segment of Freeway*

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2005
Principal Investigator(s):	Jeff McLellan	Contract Date:	04/25/2006
Contract Amount:	$12,000	Original Completion Date:	04/20/2011
Program Budget:	$15,000	Estimated Completion Date:	04/20/2011
Expenditures to date:	$10,260	Is project on schedule?	Yes
Available Amount:	$4,740	ADVANTAGE No.	R0613 17P
Percent complete	95%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

We build and expand the capacity of urban freeways with the idea that they will help relieve urban street congestion. Critics contend that new freeways worsen congestion. What is needed is an examination of the impacts that new urban freeway segments have had on urban traffic. Using the Phoenix metropolitan region as a test case, data on traffic on adjacent and parallel city streets before and after the opening of new freeway segments or capacity additions could be used to quantify the changes resulting from the new facilities.

RESEARCH OBJECTIVES

1. Estimate and document the traffic impacts of new freeway segments in the Phoenix metropolitan region.
2. Determine whether the new freeways help relieve congestion.

EXPECTED IMPLEMENTATION

ADOT will use the information to improve the agency's reputation with the general public and elected officials.

The research will lay the groundwork for conveying the message of the cost-effectiveness of urban freeways for meeting urban travel needs. ADOT's Office of Strategic Management and Budget will be the process owner.

STATUS OF THE RESEARCH

Draft final report is being revised to clarify mathematical econometrics section and define terms. 95% complete.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	**Affiliation**
Matthew Burdick	ADOT Communications & Community Partnerships (Sponsor)
John Carlson	ADOT Government Relations Office (Champion)
Vladimir Livshits	Maricopa Association of Governments MAG
Thor Anderson	ADOT Manager, Environmental Planning Group
Mike Manthey	ADOT State Traffic Engineer
Larry Langer	ADOT Valley Project Management
Floyd Roehrich	ADOT State Engineer
Kelly LaRosa	FHWA

SPR-618, *Land Use and Traffic Congestion*

Research Agency:	Richard Kuzmyak	FY Authorization:	2006
Principal Investigator(s):	Richard Kuzmyak	Contract Date:	01/30/2007
Contract Amount:	$100,000	Original Completion Date:	12/31/2008
Program Budget:	$100,000	Estimated Completion Date:	9/30/10
Expenditures to date:	$74,700	Is project on schedule?	No
Available Amount:	$25,300	ADVANTAGE No.	R061818P
Percent complete	85%	Responsible ATRC Staff: (Project Manager)	Dianne Kresich

PROBLEM STATEMENT

The way land is used affects the volume of traffic on the abutting streets. It is unclear whether sufficient attention is given to the traffic impacts of land use decisions. There is considerable controversy over whether increased density would reduce or increase traffic congestion.

Better data on the relationship between land uses and traffic congestion could help us make better land use decisions. These better decisions could lead to reduced traffic congestion, improved air quality, and lower roadway infrastructure costs.

RESEARCH OBJECTIVES

The objectives are to examine land use patterns and their contribution to mitigating or worsening traffic congestion, and to recommend options for policies that may be more conducive to reducing traffic congestion

EXPECTED IMPLEMENTATION

The research will result in data indicating how different types of land use patterns contribute to traffic congestion and whether better decisions could lead to lessened traffic congestion. The ADOT Multimodal Planning Division would be the process owner, but the Maricopa Association of Governments (MAG) and the Pima Association of Governments (PAG) may find the research results beneficial to their travel demand modeling efforts.

STATUS OF THE RESEARCH

Final report is under TAC review.

TECHNICAL ADVISORY COMMITTEE (TAC)

Mark Hodges	ADOT MPD Director of Data Management (Champion/Sponsor)
Mike Normand	ADOT MPD Director of Transit Grant Services
Jennifer O'Connor	Pima Association of Governments (PAG) planner
Tim Strow	Maricopa Association of Governments (MAG) planner
David Wessell	Flagstaff Metropolitan Planning Organization Director
Alton Bruce	City of Coolidge Economic Development Director
Kelly LaRosa	FHWA

SPR-640, *Cost-Effectiveness of Mobile Enforcement*

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2006
Principal Investigator(s):	Bao-Uyen Tran	Contract Date:	03/06/2007
Contract Amount:	$15,000	Original Completion Date:	10/31/2008
Program Budget:	$15,000	Estimated Completion Date:	12/31/2009
Expenditures to date:	$3,037	Is project on schedule?	No
Available Amount:	$11,963	ADVANTAGE No.	R0620 18P
Percent complete	40%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

Currently, MVD attempts to enforce weight limits and safety regulations for commercial vehicles through ports-of-entry and mobile details. It is the unanimous opinion of those charged with enforcement responsibility that this effort is under-funded. Yet, this opinion has been insufficient to persuade decision makers to increase the budget allocated to enforcement.

ADOT needs to do a study of the effectiveness of enforcement efforts. This particular study would focus on the mobile enforcement activities in order to determine if the benefits in terms of fines & fees collected, pavement damage avoided and crashes averted due to enforcement efforts exceed the costs of mobile enforcement details.

If we can quantify the benefits and costs per unit enforcement effort, we can establish an optimal level of effort. The purpose of this study would be to examine the costs of mobile enforcement details and compare them to the estimated impacts in terms of revenues gained, costs avoided and crashes averted directly resulting from the enforcement effort.

RESEARCH OBJECTIVES

1. The researcher will review the existing literature on mobile enforcement to assess the current state-of-the-practice.
2. With the assistance of the ATRC, the researcher will conduct a survey of other transportation agencies to ascertain whether they have ascertained benefit/cost relationships for their mobile enforcement efforts.
3. The researcher will examine data from a representative sample MVD mobile enforcement details in order to estimate costs vs. benefits.

EXPECTED IMPLEMENTATION

It is expected that the study results will help guide MVD and ADOT to implement a more cost-effective mobile enforcement program.

Planning and Administration

STATUS OF THE RESEARCH

Sections of draft final report were submitted, heavily revised at ATRC, and returned to PI. Further, unrevised sections are still at ATRC. Statistical data analysis is still pending, and PI has not indicated progress since November, 2009. 40% complete.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Stacey K. Stanton	ADOT MVD Director (Sponsor)
Steve Abney	ADOT MVD Enforcement (Champion)
Ric Athey	ADOT MVD
Michael Veucasovic	ADOT MVD
Jean Nehme	ADOT State Bridge Engineer
Kelly LaRosa	FHWA

SPR-642*, Delivery of a Technical Curriculum Using Learner-Based Instruction and Communication Modalities in a Distributed Environment*

Research Agency:	Arizona Transportation Research Center	FY Authorization:	2007
Principal Investigator(s):	Maurice Moore	Contract Date:	N/A
Contract Amount:	N/A	Original Completion Date:	05/31/09
Program Budget:	$24,000	Estimated Completion Date:	12/31/11
Expenditures to date:	$6,681	Is project on schedule?	Yes
Available Amount:	$17,319	ADVANTAGE No.	R064219P
Percent complete	25%	Responsible ATRC Staff: (Project Manager)	Steve Rost

PROBLEM STATEMENT

The problem being addressed with this research is focused on improving MVD effectiveness and efficiencies within the Executive Hearing Office and in MVD training.

(1) Within ADOT, the Executive Hearing Office (EHO) provides the public with an administrative hearing process that affords the opportunity to challenge an order or decision of the MVD that adversely affects a license or privilege. The majority of the cases heard by EHO hearing officers are the suspension or revocation of a driver license that is the result of a DUI arrest.

As required by statute, the EHO must accommodate any law enforcement agency request that a DUI hearing be conducted in the county where the violation occurred, as a result, the EHO conducts DUI related hearings at fifteen temporary locations, in addition to hearings held at the EHO's main offices in Phoenix and Tucson. In 2009, 8,159 DUI hearings were heard by the EHO, an increase of approximately ten percent over the previous year, an increase which has placed a burden on state budgetary constraints.

In an effort to ensure that efficient delivery of services to the public, as well as to reduce the number of impaired drivers who travel Arizona roads, this research will look at a pilot study on streamlining the EHO process by providing video conferencing of DUI related hearing adjudication throughout Arizona with the purchase and installation of video conferencing equipment.

(2) The complexity and volume of information a Motor Vehicle Division (MVD) Customer Services Representative must learn have increased geometrically because of new federal and state homeland security requirements, increasingly complex connectivity among the 50 states and foreign jurisdictions, and the movement of foreign state populations, organizations, products and services into and through Arizona. As in-migration continues to exceed out-migration, more MVD services will be required to serve the public throughout the state.

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Pressure to keep wait times at a designated level, marginal funding to support the increased demand for services, and non-productive lost time traveling to and from a training site have impacted how training can be delivered without requiring additional resources and in the shortest amount of time possible.

Because of the increasing size of the population, the expanded scope of training, and the scarcity of resources, training must be made as effective as possible at a minimum cost in the shortest amount of time. This portion of the research will study the effectiveness and efficiencies of dual purpose video conferencing equipment shared between the EHO and MVD training.

RESEARCH OBJECTIVE

- To document the effectiveness and efficiencies presented in the pilot study of EHO DUI administrative hearings offered through video conferencing.

- To document the effectiveness and efficiencies presented in the pilot study of MVD Customer Service Representative virtual training offered through video conferencing.

EXPECTED IMPLEMENTATION

It is expected that the study results will help the EHO and MVD training to implement a more efficient and effective EHO DUI administrative hearing adjudication process and MVD training program.

STATUS OF THE RESEARCH

This project is the kick-off stage of Phase II.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Stacey K. Stanton	ADOT MVD – Director (Sponsor)
John Carlson	ADOT MVD – Government Relations (Champion)
Maurice Moore	ADOT ITG – Central Team Lead
Omar Guillen	ADOT ITG – Custom Application Support Team
Cyndi Striegler	ADOT ITG – Internal Consulting
Mary King	ADOT MVD – Training Officer
Karen Harmon	ADOT MVD – Supervisor
Annie Parris	ADOT ITD – Technical Training Manager
Diane Minton	ADOT ITD – State Engineer’s Office
Kelly LaRosa	FHWA

SPR-646, *AASHTOWare Turborelocation Software Development*

Research Agency:	AASHTO	FY Authorization:	2008
Principal Investigator(s):	Tony Bianchi	Contract Date:	Pending
Contract Amount:	Pending	Original Completion Date:	12/31/09
Program Budget:	$100,000	Estimated Completion Date:	12/31/10
Expenditures to date:	$90,000	Is project on schedule?	Yes
Available Amount:	$10,000	ADVANTAGE No.	R064620P
Percent complete	90%	Responsible ATRC Staff: (Project Manager)	Dianne Kresich

PROBLEM STATEMENT

Payment of relocation benefits is mandated by federal regulation and state law. A relocation software package would provide agencies with the ability to allocate scarce personnel and resources to carry out relocation calculation and documentation functions that meet both federal and state requirements in a consistent manner. FHWA supports this project. AASHTO will manage the pooled fund phase of the project with participation from multiple states to pay for the product design. ADOT-R/W IT support will conduct the phase 2 implementation. Arizona is one of several states that are participating in this project.

RESEARCH OBJECTIVE

This project would be conducted in two phases. The first phase ($90,000) entails cooperation in a pooled fund effort to develop a web-based application that is easy to implement (i.e., has low in-house IT resource requirements) and has the ability to create reports both for state and federal reporting requirements. The second phase ($10,000) will entail implementing the results of phase 1 by customizing the model to ADOT's precise needs.

EXPECTED IMPLEMENTATION

States that participate in the project will own a copy of the finished product. Pooled fund product would be owned by AASHTO. R/W will own ADOT's customized version.

STATUS OF THE RESEARCH

The software has been developed and tested; remaining funds will be used to tailor it for ADOT use.

TECHNICAL ADVISORY COMMITTEE (TAC)

Sam Maroufkhani	ADOT ITD Assistant State Engineer (Champion)
Sabra Mousavi	ADOT ITD Chief Right-of-Way Agent (Sponsor)
Tony Bianchi	AASHTO Project Manager
Ben Black	ADOT ITD Right-of-Way
Dianne Ayers	Washington DOT
Perry Johnston	Arkansas DOT
Rick Kauzlarich	Alaska DOT
Carmen Reese	Idaho DOT
Arnold Feldman	FHWA
Susan Lauffer	FHWA

SPR-654, *Options & Impacts of Measures to Reduce Single-Occupant Vehicle (SOV) Traffic*

The TAC has approved a title change to: *Travel Demand Management: Strategies to Reduce Single Occupant Vehicle Trips and Increase Alternate Mode Usage in Arizona*

Research Agency:	UrbanTrans Consultants	FY Authorization:	2008
Principal Investigator(s):	Bill Obermann	Contract Date:	03/11/08
Contract Amount:	$50,000	Original Completion Date:	12/31/08
Program Budget:	$50,000	Estimated Completion Date:	9/30/10
Expenditures to date:	$41,098	Is project on schedule?	No
Available Amount:	$8,902	ADVANTAGE No.	R065420P
Percent complete	95%	Responsible ATRC Staff: (Project Manager)	Dianne Kresich

PROBLEM STATEMENT

Arizona's population is growing and with all the opportunities this will bring to the State, one of the major concerns is transportation gridlock on local streets and state highways. Perhaps incentives like tax credits for reduced personal mileage, payment for not driving alone, increased effort on ability to work at home, grocery delivery to the home, personal services at the work site or disincentives like tolls, personal tax based on higher than average mileage in a year, and charges for parking (work and social) could have a significant impact.

We need to consider more aggressive measures for reducing traffic congestion. The two largest cities, Phoenix and Tucson, already have Travel Reduction Ordinances that are targeted to employers to reduce single-occupancy trips made by employees to the work site. While these programs are making a contribution, something much stronger and dynamic may need to be implemented to increase the impact on traffic congestion.

RESEARCH OBJECTIVE

The objective would be to estimate the magnitude of impact and effectiveness of various plausible incentives and disincentives to reduce SOV travel. The research should identify the most promising options and recommend a pilot test protocol for ascertaining the effectiveness of one or more of these options in an Arizona location.

EXPECTED IMPLEMENTATION

The findings of the study will be most applicable in urban areas. The Pima Association of Governments (PAG), which serves as the study's sponsor, will own the process.

STATUS OF THE RESEARCH

The project is underway. A Webinar was conducted in August 2009 to present the findings of this research in the form of a "travel demand management toolkit." . The final report has been approved by the TAC and FHWA, and is being prepared for publication.

TECHNICAL ADVISORY COMMITTEE (TAC)

Cherie Campbell	Pima Association of Governments (PAG) Transportation Director (Champion)
Ruth Reiman	Pima Association of Governments (PAG) planner (Sponsor)
Rite Hildebrand	Pima Association of Governments (PAG) planner
Tim Strow	Maricopa Association of Governments (MAG) planner
Mike Normand	ADOT MPD Director of Transit Grant Services
Eddie Caine	Valley Metro
Kelly LaRosa	FHWA
Kayelen Rolfe	Arizona Dept. of Administration State RideShare

SPR-662, *Cost Effectiveness of MVD Fee Collections*

Research Agency:	Arrowhead Solutions	FY Authorization:	2008
Principal Investigator(s):	Chris Ciofi	Contract Date:	05/22/2008
Contract Amount:	$27,000	Original Completion Date:	12/31/2008
Program Budget:	$27,000	Estimated Completion Date:	12/31/2011
Expenditures to date:	$24,759	Is project on schedule?	Yes
Available Amount:	$2,241	ADVANTAGE No.	R066220P
Percent complete	93%	Responsible ATRC Staff: (Project Manager)	Steve Rost

PROBLEM STATEMENT

Currently, MVD collects fees for over 300 different types of transactions. Many of these transaction fees have remained unchanged for decades and may not reflect the actual cost of processing the transactions or may not generate enough revenue to cover the cost of collecting the fee. Based on this, the Arizona Auditor General recommended that MVD undertake a study of the cost effectiveness of these fees to determine which ones should, at a minimum, be increased to meet transaction cost and those that are no longer cost effective to collect or are no longer needed.

RESEARCH OBJECTIVE

The purpose of this study is to identify the total cost of each fee selected and compare the cost to the revenue generated from the fee. If the benefits and costs for each selected fee can be quantified, the optimal level of effort can be established and recommend to the state legislature for appropriate fee changes or discontinuance of fees that are not cost effective or no longer needed.

EXPECTED IMPLEMENTATION

It is expected that the study results will help guide MVD and ADOT to implement a more cost effective fee collection program. This includes recommendations for fees that should be increased to meet the estimated cost of the transaction and those that are not cost effective or that are no longer needed.

STATUS OF THE RESEARCH

This project is nearing completion – final report presentation was in January, 2010. However, the TAC has not approved certain data contained within the final report and is working with the PI for resolution. A project status report is due mid-May 2010.

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Stacey K. Stanton	ADOT MVD – Director (Sponsor)
George Delagdo	ADOT MVD – Executive Services Group, Assistant Director (Champion)
Craig Reed	ADOT MVD – Financial Resources Manager
Jean Agan	ADOT MVD – Customer Service Program
Brad Steen	ADOT TSG – Financial Management Services, Chief Economist
Sheryl Bodmer	ADOT TSG – Financial Management Services, Financial Systems Manager
Karen King	FHWA

SPR-676, *Assessing How "New Media" Can Bolster ADOT's Outreach and Communication Effectiveness*

Research Agency:	Pending	FY Authorization:	2009
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	Pending	Original Completion Date:	06/30/2011
Program Budget:	$125,000	Estimated Completion Date:	06/30/2011
Expenditures to date:	0	Is project on schedule?	Yes
Available Amount:	$125,000	ADVANTAGE No.	R067621P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Dianne Kresich

PROBLEM STATEMENT

The Arizona Department of Transportation (ADOT) has a compelling interest in examining how recent technological advancements might support improved outreach and communication activities with the diverse residents of the state. As the Web has evolved, users are seeking richer, more personalized experiences. Emerging tools on the Web may allow the Department to better connect with customers. This research would explore opportunities that could be integrated into ADOT's existing Web site platform to form a foundation for which the Department can implement strategically aligned outreach efforts. This research will help ADOT allocate resources, manage costs, and improve public trust in the agency's statewide progress and efforts. This research will serve as the foundation for an implementation plan to make better use of New Media resources.

RESEARCH OBJECTIVES

(1) Evaluate the range of feasible Web 2.0/New Media technologies available and applicable to ADOT. (2) Define stakeholder knowledge of these tools, previous experience using them and interest in receiving ADOT information from a means identified as New Media. (3) Assess the type of information Arizona residents are interested in receiving via New Media techniques and the approach the agency should take in approaching these new tools. (4) Develop and launch two or more research-based New Media outreach tools and assess the effectiveness from a baseline status through programmatic integration.

EXPECTED IMPLEMENTATION

It is expected this research will identify New Media communication strategies that can be repeatedly used in the fulfillment of the department's strategic plan and embedded into existing outreach programs to demonstrate agency innovation and excellence.

STATUS OF THE RESEARCH

The RFP has been issued, and proposals are under evaluation. The project has not yet been awarded.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Tim Tait	ADOT CCP (Champion)
Matt Burdick	ADOT CCP Director (Sponsor)
Patricia Powers-Zermeno	ADOT CCP
Sally Stewart	ADOT CCP
Kelly LaRosa	FHWA

SPR-683, *Feasibility Test of CAD Web Menus*

Research Agency:	KnowledgeBase Consulting Group	FY Authorization:	2009
Principal Investigator(s):	Kevin Fern	Contract Date:	12/01/008
Contract Amount:	$75,000	Original Completion Date:	12/31/2009
Program Budget:	$75,000	Estimated Completion Date:	12/31/2009
Expenditures to date:	$74,875	Is project on schedule?	Yes
Available Amount:	$125	ADVANTAGE No.	R068321P
Percent complete	99%	Responsible ATRC Staff: (Project Manager)	Daryl Odom

PROBLEM STATEMENT

Computer Aided Design (CAD) standards menus are user tools for assisting in the preparation of plans. Each user group in the Arizona Department of Transportation (ADOT) utilizes its own standards menus adopted for their type of plan sheets. These standards menus are made available through numerous servers, local personal computers (PCs) and laptops. The ability to keep all of the various servers, PCs, and laptops up to date with current menus is a very difficult task due to their multiple locations and need to update each unit when a menu is updated. Therefore, some users may not be up to date with current menus until all units affected are individually updated. It is desired to explore the possibility of making standard menus available through the web so that they can be accessed through a common site by all users.

RESEARCH OBJECTIVES

The basic research objective is to pilot-test the feasibility of using web-based menus for agency-wide applications. The research tasks will include (1) selecting a pilot-test site & application, (2) writing/adapting a program aimed at achieving the objective, (3) testing this program for an appropriate period to ascertain its cost-effectiveness for possible agency-wide uses, (4) documenting the results in a written report.

EXPECTED IMPLEMENTATION

It is expected that the study will examine the feasibility, costs & benefits of adopting this technology throughout the agency.

STATUS OF THE RESEARCH

This project is essentially complete and is in preparation for publication.

Planning and Administration

TECHNICAL ADVISORY COMMITTEE (TAC)

Daryl Odom	ADOT CAD Services (Project Champion)
Mary Viparina	ADOT Roadway Design (Project Sponsor)
TJ Swanson	ADOT ITG Security
Mike Smith	ADOT Engineering Survey Section

SPR-686, *Arizona Highways Magazine's Impact on Tourism*

Research Agency:	Arizona State University	FY Authorization:	2009
Principal Investigator(s):	Kathleen Anderek	Contract Date:	01/12/2010
Contract Amount:	$25,000	Original Completion Date:	09/30/2010
Program Budget:	$25,000	Estimated Completion Date:	09/30/2010
Expenditures to date:	0	Is project on schedule?	Yes
Available Amount:	$25,000	ADVANTAGE No.	R068620P
Percent complete	20%	Responsible ATRC Staff: (Project Manager)	Dianne Kresich

PROBLEM STATEMENT

Arizona Highways Magazine (AHM) is a world-renowned travel publication. A study completed in 2005 (SPR-568, Arizona Highways Magazine's Impact on Tourism) identified a wide range of important links between the magazine's readers and tourism in Arizona. The study found that:

Subscribers have spent an average of over $136.4 million annually over the past five years, and $34.7 million of those expenditures can be directly attributed to AHM and its influence on the travel behavior of out-of-state subscribers. Given AHM's annual cost of $9.6 million, this amounts to a benefit/cost ratio of 3.6 to 1 at the very least.

RESEARCH OBJECTIVES

The purpose of this research will be to update the results of the 2005 study, particularly that which quantifies the link between AHM and tourist traffic and revenue. It will also present the current implications for highway facility needs and revenue generation.

EXPECTED IMPLEMENTATION

The AHM publisher will determine how to modify processes at the magazine to best implement the research findings. The magazine will be the process owner.

STATUS OF THE RESEARCH

The study is underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

Win Holden	Arizona Highways Magazine Publisher (Champion)
John Bogert	ADOT Chief of Operations
Robert Stieve	Arizona Highways Magazine Editor
Bob Allen	Arizona Highways Magazine Finance Director
Kelly LaRosa	FHWA

SPR-695, SB2010-*33: National Household Travel Survey Supplement for Arizona*

Research Agency:	Pending	FY Authorization:	2009
Principal Investigator(s):	Pending	Contract Date:	Pending
Contract Amount:	$25,000	Original Completion Date:	Pending
Program Budget:	$25,000	Estimated Completion Date:	Pending
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$25,000	ADVANTAGE No.	N/A
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Keith Killough Dianne Kresich

PROBLEM STATEMENT

From April 2008 through May 2009, the Federal Highway Administration (FHWA) conducted the National Household Travel Survey (NHTS). Arizona will receive 500 surveys from the national sample. The Maricopa Association of Governments (MAG) and the Pima Association of Governments (PAG) purchased 4,286 and 2,200 add-on samples for their respective planning areas. Based upon the population proportions in the MAG and PAG regions, an estimated 375 of the Arizona allocation will be collected in these regions, while only 125 NHTS samples will be available for the rest of the state. This project supplements the Greater Arizona sample with an additional 250 NHTS-compatible surveys for the remaining urbanized and rural areas of the state that will be used for travel behavior analysis and the development of a statewide travel model.

RESEARCH OBJECTIVES

The proposed project will supplement the 2008 NHTS sample for Greater Arizona outside the Phoenix (MAG) and Tuscon (PAG) metropolitan regions.

EXPECTED IMPLEMENTATION

The resulting dataset composed of the 2008 NHTS and this supplemental project will provide the needed database for the estimation, calibration, and validation of statewide travel demand components of trip generation, trip distribution and mode choice. ADOT's Travel Demand Modeling & Analysis Group in the Multimodal Planning Division will be responsible for utilizing the deliverables of this project.

STATUS OF THE RESEARCH

The study is not yet underway.

TECHNICAL ADVISORY COMMITTEE (TAC)

TBD

Structures – PROJECTS

SPR-493, *Bridge Foundation Design Parameters and Procedures for Bearing in SGC Soil*

Research Agency:	Arizona State University	FY Authorization:	2000
Principal Investigator(s):	Dr. Bill Houston	Contract Date:	11/18/00
Contract Amount:	$214,808	Original Completion Date:	05/17/02
Program Budget:	$214,808	Estimated Completion Date:	11/30/04
Expenditures to date:	$180,596	Is project on schedule?	No
Available Amount:	$34,212	ADVANTAGE No.	R0493 12P
Percent complete	90%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

Drilled shaft foundations support a significant portion of the bridge substructures in Arizona. These drilled shafts are commonly supported in mixed soils types known as sand-gravel-cobbles (SGC) layer and derive their capacities from side friction and end bearing in SGC layer. Current design procedures and parameters are based on uniform soil conditions. Soils medium is modeled either as clay or sand. Limited amounts of research data are available for design of drilled shafts supported in granular soils with significant gravel and cobble contents. Current American Association of State Highway and Transportation Officials (AASHTO) design method for drilled shafts in granular soils medium is based on the equations proposed by Reese and O'Neil (Federal Highway Administration (FHWA) Procedure). Meyerhoff and Kulhawy developed the other two common design procedures. Available load test data indicate that measured drilled shaft capacities tend to be larger with an increase in gravel content of the granular soils than the design capacities. Additionally, the capacity tends to increase with the increase of calcium carbonate cementation. However, definitive relationships among these variables and corresponding design parameters are not available for general design applications. Drilled shafts in mixed soils (i.e., SGC) conditions will support significant number of bridge foundations in the future. Significant savings could be realized if design parameters and procedures could be developed to account for the increase in friction of soils with the increase of gravel content and calcium carbonate cementation.

RESEARCH OBJECTIVES

1. Prepare an evaluation of the current AASHTO design methods for Drilled Shaft foundation.
2. Prepare a comparative analysis of Drilled Shaft foundations based on AASHTO design method and those based on load tests in granular soils with gravel and cobbles.
3. Evaluate the added strength of soils due to the presence of gravel and cobbles along with/without cementation in soils.
4. Recommend changes in design parameters and design procedures.

The following tasks will be performed:

1. Develop a Technical Advisory Committee (TAC).
2. Meet with TAC to prepare a Scope of Work and select a consultant.
3. Conduct a literature search on the issues of drilled shaft foundation design in granular soils.
4. Conduct an evaluation of the current AASHTO design methods for drilled shaft foundation, for their basis and limitations in regard to SGC materials.
5. Prepare a comparative study of drilled shaft capacities based on AASHTO design methods and those based on load test data in granular soils with gravel and cobbles.
6. Identify the design parameters that could be modified to account for additional capacities of drilled shaft foundation in SGC soils with and without cementation.
7. Develop design parameters and procedures for drilled shafts supported by SGC soils.
8. Prepare a memo for submittal to AASHTO Technical Committee T-15 for revision of the AASHTO procedure for design of drilled shaft foundations.
9. Document the research efforts and findings in a final report.

EXPECTED IMPLEMENTATION

The research has resulted in an evaluation of the current AASHTO design method for drilled shaft foundations based on the available load test data on drilled shafts in SGC soils. The research has provided information to be used to improve the design of drilled shaft foundations for bridges and structures.

STATUS OF THE RESEARCH

The draft final report is being reviewed.

TECHNICAL ADVISORY COMMITTEE (TAC)

Dan Heller	TY Lin, Inc.
Shafi Hasan	ADOT Bridge Engineering
J.J. Liu	ADOT Materials
Doug Alexander	ADOT Materials
Aryan Lirange	FHWA
Christ Dimitroplos	ADOT Project Manager

SPR-687, *Analysis of the State of the Art of Precast Concrete Bridge Substructure Systems*

Research Agency:	Northern Arizona University	FY Authorization:	2010
Principal Investigator(s):	Dr. Joshua Hewes	Contract Date:	10/13/2009
Contract Amount:	07/12/2009	Original Completion Date:	10/31/2010
Program Budget:	$25,000	Estimated Completion Date:	10/31/2011
Expenditures to date:	$0	Is project on schedule?	Yes
Available Funds	$25,000	ADVANTAGE No.	R0687 21P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Christ Dimitroplos

PROBLEM STATEMENT

Interest in accelerated bridge construction in the United States has increased markedly in the last decade because of a desire to reduce the on-site construction time and minimize traffic impacts in the vicinity of the construction zone. One means of speeding up bridge construction is prefabrication of bridge elements including both substructure and superstructure, and in 2001 the Federal Highways Administration's (FHWA) Technology Implementation Group selected prefabrication as a technology that should be developed and implemented for bridge construction in the U.S. Precasting bridge components has the advantage of removing the forming, pouring and curing of concrete from the construction site. This in turn reduces potential impacts to the environment and total time for construction, which has the added benefit of reduced disruption of traffic surrounding the construction site. This is important because costs associated with user delays can be significant. Also improved is safety since reductions in construction schedule alleviate the potential for traffic accidents within the construction area. Precasting bridge components can also improve the quality of construction and consequently lower life-cycle costs.

The State of Arizona is experiencing rapid growth and recently has been the fastest growing State in the U.S. in terms of population growth (U.S. Census Bureau 2006). This has resulted in significant increases in traffic volumes in urban areas and resulted in the need for improved infrastructure to support the needs of the public and industry. Although development of new highway transportation links will ultimately alleviate traffic congestion, the actual construction will exacerbate the problem because of the required detours and lane and speed restrictions near the construction zone. Utilization of precast construction for bridge piers and columns in Arizona offers the many benefits described above and should be considered for implementation by ADOT. Work is needed to synthesize the available research and practice information to create practical and safe design specifications and procedures.

RESEARCH OBJECTIVES:

1. Synthesize existing information on the behavior, analysis, and design of precast sub-structure systems. Literature including journal publications, federal and state reports and design standards, and conference proceedings will be surveyed. A compilation of constructed bridge projects utilizing precast substructures will also be made. Experiences

of other State DOTs that have pursued or implemented precast substructure systems will be collected.

2. This task will be an analysis of the existing research and technologies, and will identify concepts, standards, etc. that may be readily exportable to ADOT practice.

3. Based on Tasks 1 and 2, the steps required to implement precast substructure technology for Arizona bridges will be identified.

4. A final project report documenting Tasks 1 – 3 will be produced.

EXPECTED IMPLEMENTATION:

The information will support the development of an ADOT plan for future implementation of precast bridge substructure technology. Such a plan may include simply a modification and incorporation of existing design standards into ADOT practice.

STATUS of the RESEARCH

The project is in progress.

TECHNICAL ADVISORY COMMITTEE (TAC)

Jean Nehme	ADOT Bridge Group (Sponsor)
Pe-shen Yang	ADOT Bridge Group (Champion)
Aryan Lirange	FHWA

Traffic and Safety – PROJECTS

SPR-648, *Crash Related Education, Enforcement, and Engineering Factors*

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$120,000	Estimated Completion Date:	N/A
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$120,000	ADVANTAGE No.	R064820P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Crashes are the result of the coincidental occurrence of a combination of factors that exceed the driver's capability to maintain vehicle control. The ability to identify these contributing factors as education, enforcement, and engineering related would facilitate targeted remedial action.

In a typical lane departure crash an impaired driver exceeds a safe speed, the vehicle leaves the paved surface, the driver reacts by overcorrecting in an attempt to return to the paved surface, the vehicle overturns, occupants not restrained are ejected and perish. Targeting these factors with a combination of education, enforcement, and engineering efforts will provide engineers, law enforcement, and educators a better understanding of what is contributing to crashes and how to address them.

RESEARCH OBJECTIVES

Review fatal and serious injury crash reports to identify and categorize contributing factors such as overturn, type of vehicle, etc. and place in baskets similar to the Accident Location Identification Surveillance System (ALISS) database. Analyze and determine appropriate, effective education, enforcement, and engineering mitigation measures.

EXPECTED IMPLEMENTATION

Results that identify contributing factors and the associated effective enforcement, education, and engineering measures will be forwarded to the responsible agencies for incorporation into their ongoing programs.

STATUS OF THE RESEARCH

The project is not yet underway.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

TBD	ADOT Traffic Highway Enhancements for Safety, Champion/Sponsor
TBD	ADOT Communication & Community Partnerships
TBD	Arizona Dept. of Public Safety
TBD	Arizona Governor's Office of Highway Safety
TBD	Arizona Depart. of Health Services
TBD	FHWA

SPR-651, *Incorporating Safety Performance into Project Design Decision-Making for Cost Effective Safety Enhancements*

Research Agency:	Pending	FY Authorization:	2008
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$50,000	Estimated Completion Date:	N/A
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$50,000	ADVANTAGE No.	R065120P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Rigid conformity to existing policies, standards and guidelines, does not guarantee safety for the traveling public utilizing the state highway system. ADOT standards for a highway posted at 65 mph indicate a clear zone distance of 30 feet from the edge of the travel lane on level terrain with 6:1 side slopes. Typically the right of way line may be found 30 feet or more past the clear zone boundary. Within the area found between the clear zone boundary and the right of way line, a myriad of hazardous fixed objects (trees, rocks, poles, electrical boxes, etc.) are frequently struck by errant vehicles that run off the pavement edge. Preliminary Traffic HES study results indicate that a majority of Run-Off-Road accidents occur at a distance of well over 30 feet from the pavement edge. As a result, it appears that wider clear zones need to be accommodated into the expansion of the clear zone distances that ADOT uses. In addition, there may be other standards, guidelines and "rules-of-thumb" that ADOT currently uses, which need some additional evaluation as well.

RESEARCH OBJECTIVES

Research each of the existing policies, standards, and guidelines that ADOT currently uses during project development to determine whether any low-cost safety enhancements could be incorporated into any existing standards, guidelines, procedures, or policies.

EXPECTED IMPLEMENTATION

Traffic Engineering working in conjunction with other ADOT organizations will lead the search for information, results, and implementation. Follow-up research is always plausible.

STATUS OF THE RESEARCH

The project is not yet underway.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

TBD	ADOT Traffic Highway Enhancements for Safety, (Champion)
Mary Viparina	ADOT Roadway Engineering Group (Sponsor)
Terry Otterness	ADOT Roadway Engineering Group
Jacob de Raadt	ADOT Roadway Engineering Group
Mike Marietti	ADOT Traffic Engineering
Tim Wolf	ADOT Phoenix Maintenance District
Ted Howard	ADOT Risk Management
Jim Redpath	Arizona Attorney General's Office
Karen King	FHWA
Jennifer Brown	FHWA
Jermaine Hannon	FHWA

SPR-652, *Countermeasures to Reduce Large Truck Crashes*

Research Agency:	Arizona State University	FY Authorization:	2008
Principal Investigator(s):	Soyoung Ahn	Contract Date:	2008
Contract Amount:	$100,000	Original Completion Date:	12/31/2010
Program Budget:	$100,000	Estimated Completion Date:	12/31/2010
Expenditures to date:	$58,422	Is project on schedule?	Y
Available Amount:	$41,577	ADVANTAGE No.	R065220P
Percent complete	75%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

ADOT's Motor Vehicle Division reported that trucks (large and small) constitute 27% of vehicles involved in crashes and 30% of fatal crashes. Although big-rig crashes are less frequent than those involving passenger cars, their impact on fatality and traffic congestion are far greater than passenger car related crashes. Hence, countermeasures to reduce big-rig crashes are crucial from the safety and congestion management standpoint.

RESEARCH OBJECTIVES

The objectives of this research are to identify freeway segments in Arizona with high frequencies of big-rig crashes and to develop countermeasures to reduce the probability of incident occurrence.

EXPECTED IMPLEMENTATION

Findings and recommendations from this study are expected to be deployed on the identified hot spots.

STATUS OF THE RESEARCH

The project is ongoing.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

TBD	ADOT Traffic Highway Enhancements for Safety (Champion)
Mike O'Hara	ADOT MVD Enforcement (Sponsor)
Kohinoor Kar	ADOT Traffic HES
Scott Nodes	ADOT Technology Group
Ted Howard	ADOT Risk Management
Sarath Joshua	Maricopa Association of Governments (MAG)
Karen King	FHWA
Danny Calvillo	Arizona Dept. of Public Safety Commercial Vehicle Enforcement Bureau
Alan Vitcavage	Federal Motor Carrier Safety Administration

SPR-671, *Data Analysis Methodology to Identify Effective Countermeasures for Reducing Fatalities and Injuries on Arizona Roadways*

Research Agency:	Pending	FY Authorization:	2009
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$100,000	Estimated Completion Date:	N/A
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$100,000	ADVANTAGE No.	R067121P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

In Arizona, traffic crash data is available for jurisdictions statewide; however, correlated with exposure data, such as, traffic volume data, for all segments and intersections within the State is very difficult. Therefore, some of the scientific methods of identifying candidate locations/areas/methods cannot be utilized until the data needs are met. The problem is to analytically identify specific safety issues at various locations/areas within the State using best available data resources. This research will enable each of the five technical emphasis area teams and the communications subcommittee of the Arizona Strategic Highway Safety Plan (SHSP) in developing candidate locations/areas and to identify most effective implementation projects or programs to address the issues. The technical emphasis areas are as follows: (1) Restraint Usage, (2) Speeding, (3) Young Drivers, (4) Impaired Driving, and (5) Roadway/Roadside.

RESEARCH OBJECTIVES

The objective is to develop a data analysis methodology that will track progress and target efforts in the SHSP emphasis areas and communication outreach where they will be most effective. The process and results developed through the research will be used in developing projects and programs that will have an impact in reducing fatalities and serious injuries on all public roads.

EXPECTED IMPLEMENTATION

The research results will be utilized in the SHSP implementation.

STATUS OF THE RESEARCH

The project is not yet underway.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

Mike Manthey	ADOT State Traffic Engineer (Champion)
TBD	Sponsor
Tomi St. Mars	Arizona Dept. of Health Services
Linda Gorman	AAA Arizona
TBD	Arizona Governor's Office of Highway Safety
Esther Corbett	InterTribal Council of Arizona
Karen King	FHWA
Ted Howard	ADOT Risk Management
Matt Burdick	ADOT Communication & Community Partnerships

SPR-675, *Effectiveness of Young Driver Training and Graduated Licensing Laws*

Research Agency:	Arizona State University	FY Authorization:	2009
Principal Investigator(s):	Rong Pan, Jing Li	Contract Date:	10/31/2008
Contract Amount:	$200,000	Original Completion Date:	12/31/2010
Program Budget:	$200,000	Estimated Completion Date:	12/31/2010
Expenditures to date:	$49,350	Is project on schedule?	Yes
Available Amount:	$150,650	ADVANTAGE No.	R067521P
Percent complete	25%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Licensed drivers in Arizona between the ages of 16 to 19 account for only 4.22% of the total drivers in 2006; yet drivers under the age of 20 account for approximately 11% of all motor vehicle crashes. According to the Arizona Department of Transportation (ADOT) Motor Vehicle Crash Facts Report for 2006, the number of drivers, who are of age less than 20, killed due to car crashes is 57 and injured 4,858, which are 10% and 11.6% of the total fatality and injury, respectively. These statistics indicate there is a significantly higher collision rate of young drivers compared to other age groups. Speeding and loss of control are the two major causes of vehicle crashes for this age group. Furthermore, an Allstate Foundation survey shows that among 16-year-old drivers, the leading cause of fatal crashes is driver error (77%). The current Arizona law does not require young drivers to take any formal training class before the first driver license exam. Many high schools are eliminating driver education from their curriculum due to budget constraints and other priorities.

RESEARCH OBJECTIVES

To evaluate the current practice of young driver training programs, including available public service announcements, and to develop effective training curriculum and safe driving campaigns to improve young driver skills and attitude towards driving.

EXPECTED IMPLEMENTATION

The research results will be provided to ADOT's Motor Vehicle Division and the state legislature for their consideration of adopting new young driver training methods and potentially enhanced GDL laws.

STATUS OF THE RESEARCH

The project is ongoing.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

Ted Howard	ADOT Risk Management (Champion)
Cydney Demodica	ADOT MVD (Sponsor)
Rick Turner	ADOT Traffic Records
Linda Gorman	AAA Arizona
Maria Wojtczak	Driving MBA
Charles Sobczak	Driving MBA
Ted Howard	ADOT Risk Management
Karen King	FHWA
Jason Harris	ADOT ATRC

SPR-680, *Development of Intersection Performance Measures for Timing Plan Maintenance Using an Actuated Controller – Phase II: Data Collection*

Research Agency:	Northern Arizona University	FY Authorization:	2009
Principal Investigator(s):	Ed Smaglik	Contract Date:	08/07/2009
Contract Amount:	$75,000	Original Completion Date:	02/28/2011
Program Budget:	$75,000	Estimated Completion Date:	08/31/2011
Expenditures to date:	0	Is project on schedule?	No
Available Amount:	$75,000	ADVANTAGE No.	R0680 21P
Percent complete	5%	Responsible ATRC Staff: (Project Manager)	Frank Di Bugnara

PROBLEM STATEMENT

Limited resources are available for maintenance of traffic signal timing plans. Because of this, it is important to ensure that resources are allocated to signals and corridors in need of retiming. The Highway Capacity Manual (1) (HCM) provides methodologies for development of quantitative measures (Arrival Type, V/C ratio, delay) to aid in analysis, however preparation of these measures through traditional methods is labor intensive (turning movement counts, travel time studies), and not often feasible, especially for hours that fall outside of the typical work day (special events, Saturday at the mall, etc). Because of this, it is desirable to have an automated method to tabulate data at signalized intersections.

RESEARCH OBJECTIVES

Phase II of this research focuses on Data Collection. The Phase II objective is to develop a data collection module to interface with existing Arizona Department of Transportation (ADOT) intersections, as well as create updated standards for new and rehabilitated intersections that would enable data collection at these locations.

EXPECTED IMPLEMENTATION

As part of this project, the module will be deployed at up to three (3) representative locations. Assuming the results of Phase II are deemed practical by the TAC, Phase III would develop a desktop computer data storage and management system for collected data, and more importantly, a user-friendly interface to mine data for input into desired software analysis tools (such as Synchro, HCS+, etc.).

STATUS OF THE RESEARCH

Project is kicked off, and PI has completed some groundwork. 5% complete.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

Name	Affiliation
Mike Manthey	ADOT Traffic Engineering Group (Champion)
Mohamed Youssef	ADOT Traffic Engineering Group (Sponsor)
Walter Kent Link	ADOT Flagstaff District Regional Traffic Engineer
Scott E. Nodes	ADOT Transportation Technology Group / TOC Manager
Raul Amavisca	ADOT Assistant Traffic Operations Engineer
George K. Chin	ADOT Phoenix District Regional Traffic Engineer
David Duffy	ADOT Assistant State Traffic Engineer
John Harper	ADOT Flagstaff District Regional Engineer
Jeff Jenq	City of Mesa
Reza Karimvand	ADOT Baja District Regional Traffic Engineer
Robert LaJeunesse	ADOT Western District Regional Traffic Engineer
Ed Pressley	ADOT Prescott District Traffic Signal & Lighting Area Manager
Jay L. Werne	ADOT Traffic Engineering Group
Jason Harris	ADOT ATRC
Kelly LaRosa	FHWA

SPR-688, *Effectiveness of Photo Enforcement in Phoenix Metro Area*

Research Agency:	Pending	FY Authorization:	2010
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$100,000	Estimated Completion Date:	N/A
Expenditures to date:	$5,119	Is project on schedule?	N/A
Available Amount:	$94,881	ADVANTAGE No.	R068822P
Percent complete	5%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

Several national studies conclude that photo enforcement at traffic intersections has reduced injuries and fatalities across the nation. As a result of installing of photo enforcement at strategic locations (intersections), local and state agencies are able to convict offenders of either speeding or running a red light, or both. Either offense is a primary cause of most injuries/fatalities at traffic intersections.

Similarly, speeding is a primary cause of highway crashes. In early 2006, the City of Scottsdale installed photo enforcement cameras, under Arizona Department of Transportation (ADOT) permit, on SR 101 for a nine-month period ending in October 2006. During this demonstration period, average speeds on SR 101 were reduced by 9 mph and total number of injury crashes decreased by 48% and property damage only crashes decreased by 56% as cited in Arizona Transportation Research Center (ATRC) research report, SPR-684, Evaluation of the City of Scottsdale Loop 101 Photo Enforcement Demonstration Program.

RESEARCH OBJECTIVES

This proposal would research the effectiveness of photo enforcement programs throughout the Phoenix metro area. Specific objectives would be: 1) Document the speed photo enforcement and its impacts on traffic crashes on specific freeways within Maricopa County in a before and after period for which fixed cameras were installed and operational. 2) Evaluate the effectiveness of photo enforcement program from a system perspective as opposed to a single point along the system. 3) Evaluate the effectiveness of photo enforcement programs (speed and/or red light running) at select signalized intersections.

EXPECTED IMPLEMENTATION

Photo enforcement programs will continue to be monitored throughout Arizona by the Department of Public Safety, ADOT, and local agencies

STATUS OF THE RESEARCH

The project is in progress.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

Mike Manthey	ADOT Traffic Engineering (Champion/Sponsor)
Reed Henry	ADOT Traffic Engineering
Jeff King	Arizona Dept. of Public Safety
Tom Woodward	Arizona Dept. of Public Safety
Anne Ellis	ADOT ATRC
TBD	Other Organizations

SPR-693, *Development of an Enterprise Data Management System for Deployment of a Comprehensive Safety Assessment*

Research Agency:	Pending	FY Authorization:	2010
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$200,000	Estimated Completion Date:	N/A
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$200,000	ADVANTAGE No.	R069322P
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris

PROBLEM STATEMENT

With the increased focus on safety, FHWA has developed new safety analysis tools to help state departments of transportation identify their safety problems in a more scientific manner. Traditional techniques of identifying hot-spot locations lack methodological rigor. SafetyAnalyst is a set of software tools developed as a cooperative effort by FHWA and 27 participating state DOTs to improve programming of site-specific highway safety improvements. It provides state-of-the-art analytical tools for use in the decision-making process to identify and manage systemwide safety improvement programs. Deployment of this tool entails a new set of requirements for safety data. In the state of Arizona some data related to roadway inventory and traffic operation is collected. However, this information is scattered, fragmented and unevaluated. There is a need to consolidate the available data and identify the missing information in order to successfully deploy the latest analytical tools for a systemwide safety assessment. Lack of adequate databases inhibits our capability to use such tools, thus limiting our ability to make informed decisions regarding cost effective allocation of scarce safety funds.

RESEARCH OBJECTIVES

The primary objective of this research is to assess the data needs for a system-wide safety assessment, examine the existing data collection program, and identify the data gaps; develop and format the existing safety data to map it for the SafetyAnalyst software; propose a comprehensive data collection program in the above context.

EXPECTED IMPLEMENTATION

The research results will be utilized in the identification of safety programs and cost-effective allocation of safety dollars.

STATUS OF THE RESEARCH

The project is not yet underway.

Traffic and Safety

TECHNICAL ADVISORY COMMITTEE (TAC)

Pradeep Tiwari	ADOT Traffic Engineering (Champion)
TBD	ADOT Traffic Engineering (Sponsor)
TBD	Other Organizations
Karen King	FHWA

SPR-697, *SB2010-35: Wrong Way Freeway Ramp Vehicle Detection*

Research Agency:	Pending	FY Authorization:	2009
Principal Investigator(s):	Pending	Contract Date:	N/A
Contract Amount:	Pending	Original Completion Date:	N/A
Program Budget:	$25,000	Estimated Completion Date:	N/A
Expenditures to date:	0	Is project on schedule?	N/A
Available Amount:	$25,000	ADVANTAGE No.	N/A
Percent complete	0%	Responsible ATRC Staff: (Project Manager)	Jason Harris; Pradeep Tiwari

PROBLEM STATEMENT

Vehicles that enter freeway exit ramps going the wrong way present one of the most serious traffic hazards on the Arizona urban freeway systems. Approximately 350 people are killed annually in the United States as a result of wrong way crashes (Moler, 2002). This typically occurs due to one or more of these reasons: (1) the driver is impaired; (2) the driver gets distracted or is confused; (3) the signage and markings are difficult to follow. There is extensive information on practices among the states to address this problem. This study will evaluate the capabilities of Doppler radar in wrong way traffic detection.

RESEARCH OBJECTIVES

The research project is intended to evaluate the effectiveness of the Doppler radar sensor for wrong way traffic detection in a controlled environment where the motion detector will be combined with a PC-based controller. This will include the evaluation of the effectiveness of the sensor and the potential for unrelated traffic to cause interference with the system. The research project will also evaluate the effectiveness of the system in a real-world environment where the entire system (radar motion detector and controller) is installed on a freeway exit ramp and staged events are conducted to determine whether the system accurately detects wrong-way traffic. An infra-red camera will also be evaluated as a data collection tool to aid in the validation of the system's operation.

EXPECTED IMPLEMENTATION

The study results will be used to set up a test location for a wrong-way detection system.

STATUS OF THE RESEARCH

The project is not yet underway.

Traffic and Safety

PROPOSED TECHNICAL ADVISORY COMMITTEE (TAC)

Mike Manthey	ADOT State Traffic Engineer (Sponsor/ Champion)
Karen King	FHWA
Kohinoor Kar	ADOT Traffic Engineer
Scott Nodes	ADOT Assistant State Engineer
Pradeep Tiwari	ADOT Traffic Engineer, Project Manager

Other TAC members to be determined.

Research Support Programs

SPR-110*, ATRC Library Resources*

This budget item provides for the following services on an ongoing basis:

Technical—Requests and receives new publications from federal, state, and private sources, classifies and catalogs new materials, maintains the library computer databases, maintains circulation records.

Service—Provides complete research assistance, including customized bibliographies from computer databases for Arizona Department of Transportation (ADOT) staff upon request, distributes library materials to ADOT staff, provides photocopies of articles upon request, provides interlibrary loans of books.

Public Awareness—Monitors the printing and distribution of all Arizona Transportation Research Center (ATRC) publications, coordinates the efforts taken to increase public awareness of ATRC, provides brief library presentations to ADOT staff upon request, maintains the ATRC Internet and Intranet sites.

SPR-111*, AASHTO and Transportation Research Board Correlation Service*

This budget item is established to enable ADOT to participate in research studies initiated by the American Association of State Highway and Transportation Officials (AASHTO), implement the results of AASHTO work, and to support the annual subscription to the Transportation Research Board (TRB) Correlation Service. Dues for participation in AASHTO's National Transportation Product Evaluation Program (NTPEP) are provided by this item.

SPR-112*, Administration of Research*

The budget for Administration of Research is based on the prior year's expenditures and the planned projection of activities for Fiscal Year 2010. The ATRC is responsible for initiation, technical review, coordination, and implementation of the research activities of ADOT. Other participating charges made to Administration are out-of-state travel expenses to national/regional conferences, short courses or seminars.

Other administrative costs are computer use, in-state travel, and office supplies. Research personnel are responsible for the publication of many reports derived from these activities. Payroll expenditures for secretarial service and typing are charged as overhead costs of operation of the ATRC, as well as graphic artwork and printing.

SPR-112, *Administration of Research (continued)*

This budget item also provides for state services rendered in support of the SPR program. Examples include, but are not limited to, engineering consultant services and external/internal audits. Other costs include miscellaneous services, employee-related expenses, and membership in or support for professional organizations such as ITS America.

SPR-113, *Support Staff Salaries*

This budget item is established to provide the funding for additional staff support for the ATRC. The additional staff provides the expertise to manage and conduct research identified in the State Planning and Research (SPR) Program.

SPR-114, *Research Reports – Technical Editing and Printing*

This budget item provides support for research report editing and publishing.

SPR-116, *Product Resource Investment Deployment & Evaluation (PRIDE*)

The PRIDE program coordinates the review and acceptance of new products for possible use by ADOT and maintains the Approved Products List (APL). The ATRC PRIDE program administrator coordinates the program with two Product Evaluation Committees: Materials, and Traffic Control.

SPR-117, *Local Technical Assistance Program (LTAP)*

This budget item is to identify the State's portion of the LTAP undertaking for this fiscal year. Annual renewal is subject to co-sponsorship by the Federal Highway Administration (FHWA).

SPR-118, *Transportation Research Quick Study (TRQS) Program*

This budget item provides funds for specific research topic support. TRQS studies are limited to budgets of $5,000 or less.

SPR-125, *NCHRP*

The National Cooperative Highway Research Program (NCHRP) is an applied, contract research program that develops near-term, practical solutions to problems facing transportation agencies.

Research Support Programs

SPR-127, *Small Budget Studies*

These funds provide an annual allotment specifically designated for small budget projects ($25,000 or less). These projects may be undertaken at any time during the year.

SPR-994, *MPD Portfolio Adjustment Projects*

These funds will enable the MPD Director, working with the research director and staff, to commission studies that will balance the research portfolio in accordance with FHWA Performance Measures.

SPR-995, *Director's Special Projects*

These funds are set aside for projects requested by ADOT executive management at any time during the year.

SPR-996, *Project Additions*

These funds are available to fund expansions or additions to existing research projects.

SPR-997, *Participation Projects*

These are funds available for participation in research projects with other states.

SPR-998, *Budget Closeout Funds*

Carry over funds from budget years that are closed out do not become available for 6-12 months after the budget year is closed down. These funds are used to finance active projects from the closed year until the rollover funds become available.

SPR-999, *Special Projects/Contingency*

This is a placeholder for unused funds from completed projects and a reserve for project additions and executive management projects above the planned amounts. They can also be used to fund additional projects supported by the Research Council in either the major project selection process or the small budget program.

Pooled Fund Projects

Current Pooled Fund Projects

Project No.	National Studies	Obligated Amount	Project Manager
TPF-5(105)	Transportation Library Connectivity	$5,000	Dale Steele
TPF-5(166)	Application of Three-Dimensional Laser Scanning for the Identification, Evaluation, and Management of Unstable Highway Slopes	$30,000	Christ Dimitroplos

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